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THE PRACTICAL TEACHER

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THE EDUCATIONAL OUTLOOK.

BY J. H. YOXALL, M.A., M.P.

NOT for two months or so can anything authoritative be announced here concerning legislation on education in the session of 1908, but in the meantime it will be useful to consider how administrative matters stood at the beginning of the new year, according to the report of the Board of Education for 1906–7, and how they are likely to develop.

Teachers' Superannuation.

The first septennial actuarial inquiry into the condition of the Teachers' Annuity Fund has been completed. It had to do with the amassed sums contributed by the deductions of £3 or £3, 5s. (from men) and £2 or £2, 4s. (from women) made in grants payable to schools in which certificated teachers, who accepted the Superannuation Act of 1898 or have been certificated since then, have rendered recorded service during the period April 1899 to April 1906; it had nothing whatever to do with the money paid or payable to teachers as superannuation allowances or disablement allowances by the State. This inquiry into the age, length of recorded service, and number and respective amounts of contributions of each certificated teacher in Great Britain—England and Wales separately and Scotland separately, the men's fund separately and the women's fund separately—proved to be even more laborious and complicated than was at first anticipated, and the actuary (Mr. George King, who has had more experience than any one else in investigating the condition of other such funds in railway and similar superannuation systems) was unable to send in his report in time for it to be laid before Parliament last session. The report has now been received by the Treasury and the Board of Education, and will be laid before Parliament at an early date. It is at present a private State document, but the Board announce that "no action will be taken upon it until full opportunity has been given for its consideration." That means, among other opportunities, full opportunity for the representatives of the National Union of Teachers and of the Educational Institute of Scotland to consider the report and make representations about it generally, and in particular about any proposed changes in the rates of annuity or other tables concerning the fund.

Teachers' Registration.

The almost wickedly foolish and inept system of registering teachers, which came into existence under an Act of 1899, has long been moribund; it is now legally as well as actually dead. No new names of elementary school teachers were added to the register during 1906–7, and very few names of secondary school teachers either. Up to September 1907 only twenty men had been registered in Column B, under the regulation requiring "training" as a condition, and no more than 260 women. The Administrative Provisions Act, which became law on January 1 this year, relieves the Board of Education of "any obligation to frame, form, or keep a register of teachers." But that Act authorised "His Majesty in Council to constitute a Registration Council representative of the teaching profession, to whom shall be assigned the duty of forming and keeping a register of such teachers as satisfy the conditions of registration established by the Council for the time being, and who apply to be registered." Communications between societies of teachers in England and Wales are going on, with the view of arranging and suggesting to the Crown an agreed and representative constitution for the Registration Council. The register itself "is to have but a single column," says the Board of Education's report, "containing the names and addresses of all the registered teachers in alphabetical order, and such further particulars as the Council may determine to give."

The Consultative Committee.

It was the Consultative Committee of 1900–1 which conceived the almost wickedly foolish and inept register system which events nullified and Parliament had in the end to kill. It was much the same set of people who concocted the report on Higher Elementary Schools, which the National Union of Teachers and the Labour organisations attacked so successfully. One happy result has been a transformation of the *personnel* of the committee—the Board of Education's report calls it a "reconstitution." Everybody will regret the resignation of Sir William Hart-Dyke as chairman, and most people who know the facts of the case are glad that the following new members have been appointed:—Miss Cleghorn, Sir Henry Hibbert, Mr. Marshall Jackman, Mr. Albert Mansbridge (Workers' Educational Association), Mr. J. L. Paton, Sir Henry Reichel, Professor Sadler, Mr. Shackleton, M.P., and Mr. Arthur Sidgwick. Mr. S. H. Wells, on his appointment to the Egyptian Civil Service, resigned his seat on the committee, "to the great regret both of the committee and the Board," says the report. It is fair to quote that, because the regret is hardly so great among people who know the history of the register and the Registration Council of the past. At the beginning of 1908, however, it seems as if the past action of some of the persons above named has, by recoil, brought into existence the elements of unity among the teaching profession; and if all ends well, then all is well, even the temporary irritations and frustrations of the past, for out of that evil good will have come abundantly. There was never such a prospect of professional unity before.

The Welsh Department.

The constitution of a special department for the administration of education in Wales, "under the control of a permanent secretary and a chief inspector," each responsible directly to the President of the Board, took place in February 1907, but "the Welsh Department has not yet been able to take over and enter upon all the duties which will eventually devolve upon it," says the report. So far as this Department has gone, it would seem that neither a Welsh Department nor a President who is a member of Parliament for a Welsh constituency can cope with what is called the Welsh Revolt, or cause all Welsh local education authorities to administer the law with justice to all children and all teachers. Part of the cloudy outlook in 1908 is due to that, and it may be that the existence of a Welsh Department will increase the very difficulties which it was intended to assuage.

The New Medical Department.

It is with surprise, not to say consternation, that one reads in the report that the new Medical Depart-

ment is to be manned by medical men. The advantage of having inspectors of schools who know nothing, or next to nothing, about the practice of education has been so long recognised by the Board, and the principle is so firmly established, that the natural expectation was for the Medical Department to be composed of clergymen or auctioneers or schoolmasters, or anybody else who was professionally and practically ignorant of the art and mystery of medicine, surgery, and diagnosis. This new Department is to administer those provisions of the Act of 1907 which authorise the medical inspection of school children not less than three times during a child's school life. It is to be hoped that this new duty will be carried out in a way to secure the co-operation of local authorities, parents, and teachers, and not in a way to set up some easily set-up backs. It is possible, of course, that the medical men may be wiser than some of the young 'varsity men who are employed to make the Education Code and inspect the work of the schools; but we shall watch the operation of this dangerous innovation in bureaucracy during 1908 with a good deal of anxiety: it is such a departure from "the good old plan" of setting the unversed to direct, criticise, and supervise the expert and practical.

The Training College Difficulty.

In another instance, however, the Board have departed from their time-honoured practice, and in this particular there appears to be some danger that Training Colleges during 1908 may find themselves left without grants, and actual students in training left without Training Colleges. The ancient connection between clergymen and the training of teachers has been rudely interfered with. "In the past," says the Board, "the acceptance or refusal of candidates has been left almost entirely in the hands of the college authorities, with the result that access to a large majority of the residential colleges has been restricted to students who belong to some particular denomination, and have satisfied the authorities as to their knowledge and acceptance of the tenets of that denomination." That is now to be changed. The Archbishop of Canterbury has intimated to the Board that the trust deeds of the colleges forbid that it should be changed. The Board reply that "it will be for the authorities of the college to decide whether they are desirous of continuing to receive grants from public funds." If they are, are they willing "to obtain an amendment of their trusts"? If not, what then? Obviously the grants will then be withheld, and the students in the colleges at the time will lose their training, in part or altogether.

Decrease of Voluntary Schools.

Of course this second departure by the Board from the older paths is due to that very "religious difficulty" which hangs over education in 1908 the largest and the darkest cloud. What the Bill may be, or whether it will become an Act, is too early to consider now; but in the meantime, and in any event apparently, voluntary schools decrease, and will decrease, in number. "Between January 1, 1906, and August 1, 1906, there was a net increase of sixteen on the number of ordinary public elementary schools, the number of Council schools having increased by 180, while the number of voluntary schools decreased by 164; the number of voluntary schools closed exceeded the number opened by fifty-six." It must be remembered that "schools" does not necessarily mean "departments," and a closed "school" may mean three closed "departments." This closing process, steadily and largely going on since 1902, adds to the troubles which voluntary school managers and teachers may expect from legislation this year.

Growth of the Half-Time System.

It is to be hoped that the half-time system may be at least winged and wounded during 1908, but at present it is going stronger than ever. The number of departments in respect of which additional attendances are claimed for partial exemption scholars has continued to increase, the number being 2,935 in 1905–6, as compared with 2,470 in 1904–5 and 2,088 in 1903–4. The number of partial exemption scholars has also increased, being 82,328, as compared with 80,368 in 1904–5 and 78,876 in 1903–4.

Number of Certificated Teachers, etc.

The year 1906 began with 84,274 certificated teachers in employment in England and Wales, the number of them in proportion to the number of other adult teachers (uncertificated, supplementary, and provisional assistant) being roughly in the proportion of four to three. The number of scholars in average attendance per certificated teacher was 62·93. It would appear that during 1907 the supply of certificated teachers has overtaken, or almost overtaken, the demand, but the necessary reduction in the size of classes and the proportion of scholars to a certificated teacher goes on very slowly.

Control of Secondary Schools, Pupil Teachers' Centres, etc.

In the same document which records that for the future fees in secondary schools may be lowered, and not less than one quarter of the total number of scholars admitted must ordinarily enter without fee at all, there are evidences that the effort of the Board to remove the management of such schools out of the hands of education committees appointed by Local Authorities is to be continued, and that the Board's depreciation of pupil teachers' centres goes merrily on. Trouble and the need for action of a democratic kind lie ahead in these directions, and the whole tone of that part of the report which deals with secondary schools is hoity-toity, imbued with Harrow and Eton feeling, and unsatisfactory in other ways. It is, in fact, quite out of keeping and ridiculously out of harmony with the portions of the report concerning undenominationalism, and with the continuance of education among the working-classes. The unfitness of the persons who control the secondary schools branch of the Board of Education to do the work in a modern and liberal spirit is again made manifest, and with it is demonstrated the unwillingness or inability of the President to rule or overrule his own Board.

Indeed, the chief problem, apart from legislation, in educational affairs during 1908, will consist in the personality of Mr. M'Kenna. He is able, but not highly intellectual; he has neither the genius nor the pleasant humility of Mr. Birrell. It may well be that in 1908 the friends and supporters of education for the people may have to turn from a professedly Liberal administration to the Labour benches for aid, and to the official Opposition also.

LORD KELVIN.*

LORD KELVIN, whom the whole Empire mourns, was a pre-eminently great man of science, whose intellect eclipsed that of his scientific contemporaries, and whom the judgment of posterity may class with his greatest predecessors in physical research and speculation.

The simplest and truest thing to say about Kelvin is that he had in an incomparable degree the power to apply abstruse theory to the most ordinary uses. He dreamed of the composition of matter in terms of supreme subtlety that had to be invented for his purpose, yet he set himself with no less zest to overcome the mechanical worries that beset the humble householder and the unintelligent plumber. He designed a water-tap which can be turned off without communicating a shock to the pipe; and other small domestic appliances in British homes remind us of his contempt for knowledge that bears no fruits.

The range of his inquiries was astonishing; he busied himself with so many branches of science that one might be tempted to think that he was superficial in some if the material applications of his genius were not present to confound us. Nearly everything that he invented was a perfect fulfilment of what he set out to do. One does not hear that his mariner's compass, for instance, or his deep-sea sounding apparatus, or his instrument for recording and predicting the tides needs improvement, or even that his non-shock tap will presently be perfected by some one else along the same lines. He always saw how far the lines led, and he invariably went to the end of the journey. Besides having the power to apply theory, he had the instinct to make the application commercially practicable. Thus one could always see in his case a threefold process at work: brilliant theory, application of theory, and the businesslike capacity to secure that the invention should be of some use to "the man in the street."

We know of no one in whom these three qualities were more manifestly mingled than in Lord Kelvin. He may have regarded Stokes as his master in the domain of pure mathematics, but, take him for all in all, in the world of science he had no master. "All science is one," he used to say; and, really, his accomplishments force one to admit that he proved the truth of that spacious pronouncement.

William Thomson, the future Lord Kelvin, came of farmer stock in the north of Ireland. His father virtually educated himself, and yet became Professor of Mathematics in Glasgow University, and the son began to study in that university when he was still a child. Later, William Thomson went to Cambridge, where he became Second Wrangler—which reminds us of a curious observation we heard recently, that the mathematicians who have shone most in the world have been Second, not Senior, Wranglers. After becoming a Fellow of Peterhouse, he returned to Glasgow as Professor of Natural Philosophy; but the world did not hear much of his masterly scientific researches till he was knighted in 1866 for his labours in connection with the Atlantic cable. The celebrations at Glasgow in 1896, when he had spent fifty years in his professorship, were perhaps the most memorable tribute ever paid to the scientific achievements of one man, and also the most singular testimony to the cohesion of men of science all over the world.

We cannot do more than choose a few points to illustrate Kelvin's versatility. Let us take the dispute, still vividly remembered, in which he fought with the geologists. The dispute was characteristic on his side, because, having previously arrived at his theory of heat, it was inevitable that he should apply it as soon as possible outside the immediate scientific domain in which he had evolved it, and in which other investigators might have allowed it to lie fallow.

He turned his attack against those who, untrammelled by knowledge of the latest physical theories, held that almost unlimited time must be assumed to account for the geological formations of the world. Kelvin pointed out that this did not fit in with the results of his thermo-dynamical investigations. These had shown that heat—which is only another name for energy—was being continually wasted, and, making the most handsome concessions he thought permissible to the geologists, he could not allow the vast periods of time they postulated. He held, indeed, that the earth had solidified less than twenty million years ago. Since then, of course, geologists have modified their conclusions by saying that, though the gradual formation of the world cannot have changed in character, it may have varied in degree.

Again, the recent discovery of new elements may ultimately give us quite a new theory of the conservation of heat; but the way in which Kelvin argued his case on his data was a revelation of the man. That controversy, as we have said, was the culmination of his thermo-dynamic theory. In that field he disinterred from undeserved oblivion the significant treatise of Sadi Carnot on the motive power of heat. Working in conjunction with Joule, he modified Carnot's theory of heat, though to Joule is due the credit of determining the dynamical equivalent of heat; in other words, of proving that heat is a form of motion. Kelvin elaborated the principle, and eventually announced the well-known theory of the dissipation of energy.

A more curious speculation still was Kelvin's Atomic Theory. This is the famous theory which supposes that matter is composed of indivisible vortex-rings. Many properties of matter were explained in this way, and for some years could be explained in no other. Recently, of course, the vortex-rings have been superseded by electrons.

Kelvin himself said at his jubilee in Glasgow: "One word characterises the most strenuous of the efforts for the advancement of science that I have made perseveringly during fifty-five years. That word is failure. I know no more of electric and magnetic force, of the relation between ether, electricity, and ponderable matter, or of chemical affinity than I knew and tried to teach to my students of natural philosophy fifty years ago in my first session as professor." But he added: "What splendid compensations for philosophical failures we have had in the admirable discoveries by observation and experiment on the properties of matter, and in the exquisitely beneficent applications of science to the use of mankind, with which these fifty years have so abounded!" It is of those "beneficent applications" that we must now say a word.

The first Atlantic cable of 1858, it will be remembered, broke down after a short use, and it was not till Kelvin brought his brain to work on the problems that they were solved. The original cable, using powerful currents, could not transmit clear and rapid signals, yet it was almost universally believed that

* From *The Spectator*, by kind permission of the Editor.

without those very strong currents messages could not be sent at all. Kelvin saw that if the currents must be weaker, their value must be increased by making the receivers more sensitive. He then invented his mirror galvanometer, by which the movements of the magnet are magnified so that the effect to the eye is as clear as that of the old-fashioned galvanometer worked by a vastly stronger current. The cable of 1866 worked well with this device, and the speed of transmission was enormously increased.

The next year he invented the siphon recorder, which was an improvement on the mirror galvanometer, in that it automatically recorded the messages. But perhaps the best known of all Lord Kelvin's numerous inventions is his mariner's compass. The old-fashioned compass was unsteady in proportion to the unsteadiness of a ship, and so unscientific was the treatment of the whole subject that it was actually common to make the compass steadier by the fatal device of increasing the friction on the bearing-point. Kelvin saw that a steady compass was to be obtained on the same principle as a steady ship. Just as a vessel rolls most violently when its vibrational period is the same as that of the waves, so a compass oscillates most when its period coincides with that of the ship. The remedy in both cases is to make the periods as different as possible. This he did by making the compass-card very light. Another improvement was the introduction of needles of small magnetic force, and of such shortness that the magnetic error had not to be overcome by large and clumsy magnets and pieces of iron.

As a teacher Lord Kelvin is said often to have assumed too much knowledge in his audiences. But his was an inspiring and lovable character; with clarity and reverence of mind he confessed how humbly man should walk upon the earth. "Forty years ago," said this great physicist in 1903, "I asked Liebig, walking somewhere in the country, if he believed that the grass and flowers which we saw around us grew by mere chemical forces. He answered, 'No, no more than I could believe that a book of botany describing them could grow by mere chemical forces.' Every action of human free-will is a miracle to physical and chemical and mathematical science."

SCHOLARS AND SCHOOLS IN PAPUA.

BY SIDNEY H. RAY, HON. M.A., CAMBRIDGE.

IN the year 1898 I had the opportunity of visiting Torres Straits and New Guinea with a scientific expedition sent out under the auspices of Cambridge University. The purpose of the expedition was purely anthropological, to study the natives and everything concerning them. My own special work related to the languages of the people, a subject which had never before been fully investigated on the spot by a European, but I had, of course, incidentally to learn something of folk-lore and customs. As a practical teacher, too, I was naturally interested in the native children.

The islanders of Torres Straits are in appearance very much like the New Guinea people on the coast north of the Straits, and are totally different from the Australians, who are their near neighbours at Cape York on the south. The islanders are Papuans, long-headed (dolichocephalic) in the east, but mixed with broader-headed (brachycephalic) people in the west. They have skins of a deep brown colour, and the typical crisp, frizzled hair from which the people and island of New Guinea take their name.* But although there

NEW GUINEA (MOTU) CHILDREN.

is an almost complete identity in the physical appearance of the people of the eastern and western islands of the Straits, there is a great difference in their customs and sociology, as well as in their language. The language of the western islanders was found to be related to the Australian; that of the eastern people is Papuan, as on the opposite coast of New Guinea. It was this overlapping of races which gave interest to the study of the anthropology of these people.

A MURRAY ISLAND BOY.

Our first stay was at Murray Island, in the eastern division of the Straits. This place was chosen because

* Malay *papuwah*, crisp-haired people; *Tanah Papuwah*, New Guinea.

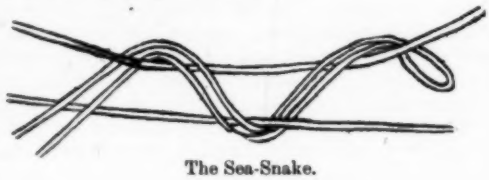
the people are comparatively free from contact with traders and the usual variety of South Sea Islanders found everywhere in the Straits. The island is difficult to reach on account of the reef-strewn waters of

A Murray Island Kolap.

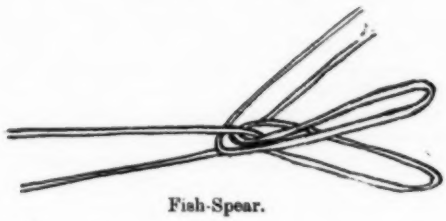
the coral sea, and on the night before reaching Murray we were nearly "piled up" on a reef through an insecure anchorage. We took up our quarters in an old mission house, and soon got into very friendly relations with the people, as they remembered Dr. Haddon, the leader of our party, who had spent some time on the island ten years before.

In Torres Straits the old customs and ceremonies of the people are things of the past, and it was to gain a knowledge of these before they passed from the memory of the living that the Cambridge expedition visited the islands. Savage education aimed at fitting the child for the serious business of life—for manhood, warfare, and hunting—but with the advent of civilisation the former things have passed away. We educate our youth in the use of their brains and hands, and praise courage, endurance, and *sang-froid;* but as regards the latter virtues, we cannot, as the savage does, enforce them by extreme measures. In Murray Island the older men showed us how the boys were initiated into manhood; how they were shown the sacred masks, and had explained to them the real significance of the performances with these, which they had previously believed to be animated by real ghosts or spirits. The boys were, in fact, taught the religion and social rules of their people, and the penalties for breaking them. Now in Murray Island the young are taught the lessons of the Christian law in the church and school. They learn English as well as their own language, and most of the elder boys and girls could read and write English very well, and sing English school songs. The only native literature consisted of a translation of the Gospels of Mark and John, a small primer of Old Testament lessons, and a hymn-book.

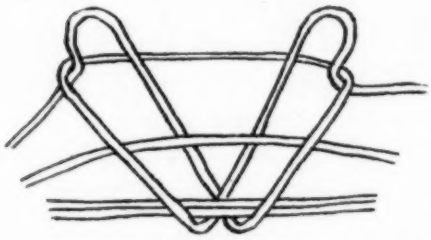
Most of the games were English, and during our visit there was a great demand for the marbles which we gave as rewards for services rendered, such as finding plants and insects. The boys especially seem to know very little of old games. On one occasion we had sports on the beach. The boys decorated themselves with petticoats and head-dresses of plaited strips of coco-palm leaves, some wearing masks. The girls made themselves bonnets of palm leaves decorated with gay flowers. The boys merely frolicked about in the water, but the girls played a game *Koko itimdare*, swimming with hands on each other's shoulders in a long chain. This wound about in the water, the fun being to cause the breaking of the chain. Another girls' game was *Tag ditilare*, in which they sat round a heap of sand singing, and at the same time plunging their outstretched fingers into the sand heap. They then drew them out, and examined them for marks made by ashes or other things in the sand. This was a kind of childish divination.



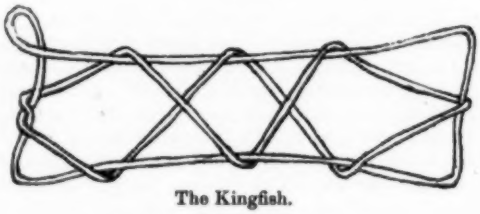
The Sea-Snake.



Fish-Spear.



Bird's Nest.



The Kingfish.

Some Kamut from Murray Island.

In Murray, however, the chief games were *Kamut* and *Kolap*. *Kamut* is the general name for a string

figure or trick, similar to the English "cat's cradle." There was a great variety of figures, and many of them had an ancient chant sung with them. Some represented movable figures, such as the sunset; the fight in which one combatant goes off with the head of his enemy; the man walking backward; the swimming sea-snake. Others represented common objects, such as the fish-spear, the bird's nest, the *tup* or "sardine." Others were tricks, such as the kingfish which was speared or escaped at the will of the maker, the lizard which slipped round the tree, the mouse or the offered yam which disappeared when about to be seized.

The *kolap* was a top from four to six inches in diameter, carefully made by the owner from a soft stone. It had a peg of hard palm wood, and was decorated sometimes with mythical figures. It was carried in a small basket for fear of injury. The spinning of the *kolap* seemed to be entirely an amusement for the men. One village would challenge another to a competition. The competitors sat on the beach in a double row facing one another. The tops were spun by rubbing the axis between the hands in the same way as the ancient fire-drill. The peg rested on a potsherd, which no doubt represented an original shell. On a given signal all hands were removed, and the tops left spinning. Songs were sung by the owners, who were allowed to shield the tops from draughts with the hands. Some tops spun for a considerable time. I find in my notes entries showing the time of the best on one occasion to be 26½ minutes, and on another 27½ minutes.

Our stay in Murray Island was broken by a visit to the mainland of New Guinea. The district visited extended along the coast from the St. Joseph River, about sixty miles west of Port Moresby, to Keapara, on Hood Lagoon, about sixty miles east of Port Moresby. The coast people here were Melanesians, lighter in colour than the Papuans, but with the typical frizzly hair. Their languages were of much simpler construction, and similar to those in the Solomon Islands. They had numerals as far as five, and counted to a hundred or more; whereas the islanders of Torres Straits and their neighbours in New Guinea and Australia only had words for one and two, and could rarely count as far as eight.

(*To be continued.*)

CHILDREN'S IDEALS.

A STUDY OF THE SLUM CHILD.

BY LAURA HELEN BATES.

IT is a noticeable fact that the personality of a child is shown to a great extent by the different types of "grown-up" people which appeal to it.

A well-bred child is quickly taught to hide its true feelings and conceal any aversion it may have conceived. It therefore loses much of its originality—and possibly truthfulness. Whether this is a good thing for the child it is not my intention to discuss in this short article.

Now among the little dwellers in the slums this is not the case. Here we see the child in its native state. It is unhampered and absolutely unchecked by conventionalities. It is free to show its likings and its dislikings—even free to make remarks which would much shock conventional society and cause considerable embarrassment.

I doubt, on the other hand, if such entire devotion and attachment is found among upper-class children as among those in less fortunate surroundings. These display a most touching affection towards "grown-up" persons who take their fancy. They, moreover, form idealist pictures of people they have heard of or read about. They conceive vivid mental pictures of the heroes and heroines in fairy tales and books of adventure. Their minds conjure up exalted ideas of sovereignty. The king and queen are surrounded with splendour quite beyond conception, and with regal state bordering on the supernatural. To these personages also are attributed every active virtue.

It has been my pleasure and absorbing interest for some time past to study this particular feature of the child mind.

The following investigations were made among children who lived in the alleys and yards of a large manufacturing town. Although in most cases poorly clad and improperly nourished, they proved to have high ideals of persons whom they should like to resemble when grown up. The critical faculty also was not wanting.

To help the research, each child wrote an essay upon "The Person I should like to resemble when I grow up." No aid whatever in spelling or composition was given, and the results were the outcome solely of their own original thought.

Although the style was unfinished and illiterate, and both spelling and composition lamentably in fault, yet the sentiments of these poor children were most commendable; and in spite of coming from squalid homes and miserable surroundings, they breathe an air of what is true and pure, of loyalty, obedience, and unselfishness, which is touching and most hopeful.

It is possibly not surprising that many of these little dwellers in the slums chose a royal personage as their ideal. To those who are acquainted with the poverty and squalor of their homes, it seems only natural that the glamour surrounding an exalted position and the outward tokens of wealth should receive an almost exaggerated admiration.

The following tribute to Queen Victoria was written by a child of nine:—

"I should like to resemble Queen Victoria becawse she was so good and kind to the poor people. She allways used to keep herself clean. When I get older I cannot be just like Queen Victoria becawse I cannot have such a quantity of money to travell all over the world, but I can try to be good."

Another short essay by a child of ten displays the exalted position which the picture post-card holds in their imagination.

"The late Queen Victoria was a splendid lady. I should like to be like her. She did much good to her country, and was put on a picture Post Card. Her motto was 'I will be good,' and she got married to Prince Albert who died soon after. Queen Victoria was left a widow. There are also post cards of her husband with all his medals on."

Some amusing facts concerning royalty are quoted by a girl of ten, who must have picked up her information from the yard in which she lived. Being a handsome girl, and having a certain love of dress and finery—including the inevitable pearl bead necklace—the glitter of riches and display possessed a great attraction for her.

"The person whom I should like to resemble is Queen Alexandra. the Reason why I should like to be like her is because she is a very good lady and everyone thinks a lot of her. She

has a very good character. She only married King Edward the Seventh, or else she would not have become the Queen. She was in middle life when she came to the throne. She thinks a great deal of her country, and all the people like her. Queen Alexandra is still halive and her husband too. He is a very good gentleman. They are very thoughtful about the poor. People will perhaps put a statue up for Queen Alexandra when she dies."

The following essay by a child of seven shows a native and rather amusing conception of the dignity surrounding royalty. Although extremely crude it displays original thought:—

"I should like to be like the Queen becawse she his so good to poor people that cannot buy shose [shoes] for there little children, and she his so highly situated that she as sarvints to wait upon her. she as some of the grand buldings in England. she as high lords to hask her wheather they his to do this or that. I suppose we all should like to be like the queen becawse when we was littler we would be princesses."

(To be continued.)

NOTES FROM THE NORTH.

AT the Dumfries Congress of the Educational Institute of Scotland the President (Mr. John M'Whan, F.E.I.S., Cambuslang) took for the subject of his address "Individualism in Education." After dealing with the progress made in education since 1872, he pointed out that there are at the present time three great drawbacks to the educational progress of the future. In the first place, our classes were too large and unwieldy. Teachers did not favour a reduction in the number of pupils in order to make their work easier or from a desire to indulge laziness. The change to them was in the method rather than in the volume of their work. No doubt large classes made more serious physical demands; but the methodical study of each unit, and the increased attention to its varying needs, would more than turn the scale. In the large class it was sometimes necessary to be content with knowing how many were right or wrong as a guide in directing the next lesson. It was easier by far to make a class of a hundred repeat the steps of an argument than to secure that each member of a smaller class tried seriously to think out the problem for himself. He thought it was now full time that parents and local authorities should consider the problem. It might be the Education Department was only waiting for the increased band of teachers to be trained under the new regulations to make another great advance.

Individualism in Education.

IN the second place, Mr. M'Whan considered that the children were too closely packed in our schools; and in the third place, that the school furniture was clumsy and inconvenient. He was of opinion that these two changes might be made simultaneously. More space was required. A room designed for sixty pupils was not too large for a class of forty. The present arrangements were bad physically and morally. Children brought up in homes where order was the first law, and where personal cleanliness received constant attention, should not be required to sit in close contact with children coming from homes of a different type. A very little exercise of the imagination would show the undesirable possibilities.

Two other Reforms required.

There was also the moral aspect of the question. It did not arise to any considerable extent amongst infants; but in the older classes the best efforts to secure independent thinking, independent effort, the valuable habit of self-reliance, were not infrequently rendered useless. It was so easy to communicate by whisper, by glance, or by a baffling but none the less effective system of signs, that hardly one answer, scarcely one exercise, was above suspicion. Pupils must not be banded together if there was to be any guarantee that each was being educated.

He thought each pupil should be provided with his own desk. The modern dual desk was only a compromise. The teacher would then have some security that the work done was honestly done, and the pupil would be freed from contamination and constrained to bear his own burden. We taught our children to pray, "Deliver us from evil," yet our school system was such that they were led into temptation. Money was at the root of all these improvements.

IN advocating such reforms as these, Mr. M'Whan did not forget that while some Boards could well afford to carry out these reforms at once, there were others whose rate entailed a burden all too heavy. So far as inequality of rating interfered with necessary progress it ought to be removed; but it baffled him to see how it could be removed without that other reform which would bring so many blessings in its train—the extension of the School Board areas for all stages of education. The Government should contribute, however, in proportion to necessarily increased expenditure. That they did not contribute sufficiently was admitted. The average rate in the counties of Scotland varied from 7d. to 1s. in the £1, and unless it was to be still further increased much more must be wrung from an unwilling Treasury. It should surely be possible to find a good deal more than £1,760,000 for education in Scotland. He was by no means sure that School Boards were not partly to blame for this niggardliness, for they had been chary of using their political influence. It would seem as if they doubted the validity of their claim. Public safety, public health, the material prosperity of the individual and of the nation, and that outlook and enjoyment of life which even material prosperity could not confer, were all involved in the reduction of the unwieldy classes and the provision of more space and better furniture. When the importance of the issues were realised, he thought School Boards would be prepared not merely to obey but to anticipate the regulations of the Department, and at the same time to insist on greatly increased imperial grants.

More Imperial Grants demanded.

THE Dumfries Congress will be known as the "Congress of Areas." There was hardly a speech made at Congress or at the dinner that had not something to say with regard to the necessity for extended areas. The resolution on the subject was entrusted to Mr. Allan Arneil, M.A., Glasgow, and was as follows: "That this Congress urges the Government to pass an Education Bill for Scotland during the ensuing session, and is of opinion that no educational legislation will be satisfactory which does not provide for the administration of primary, intermediate, and secondary education over suitably large areas by a single authority elected for that purpose." In submitting this proposition, he

Larger Areas.

pointed out that the Institute, laying down the general principle of fair equality in rating, efficiency and progress in administration, combined with sound local interest, had again declared its adhesion to the policy of larger areas, with Boards specially elected for the administration of all kinds of education. Whether that area should be the County District or delimited by an Education Boundary Commission, the Institute did not say, although the latter, in spite of rating difficulties, was to be preferred. It had been rumoured that the Parish Boards were to be retained for elementary work and County Authorities for secondary work. This seemed at first glance a feasible solution; and while any arrangement would be an improvement on the present, this proposal, on examination, presented some very obvious objections. Dual control would almost certainly result in friction, and not produce that co-ordination of administration which was desirable. Two rating authorities for education seemed superfluous, and if the County body was non-elective, it would become more or less an irresponsible body. Secondary education being more expensive than elementary, there would be a tendency to centralise higher work and reduce capital expenditure. To set one authority over another would be to degrade Parish Boards, without any compensating advantage, with the probability of the elementary schools being largely staffed by women. Parish Boards would then have no interest in higher work, and this division of authorities would be apt to accentuate class distinctions, and draw a line of demarcation between the teachers.

MR. LEANDER M. FYFE, Glasgow, delivered an address on this subject. The object of the recent regulations was, he said, to produce efficient teachers. Efficiency included culture, experience, and character. The last must be left out of the discussion, for regulations could not deal with it. It must not be forgotten, however, though there was a disposition to minimise it, if not to overlook it altogether. It was admitted that the intellectual training of junior students was likely to be superior to what prevailed in the past—(1) because it was based on a good all-round education, and (2) because more time would be devoted to it. On the basis of the intermediate examination there was to be imposed leisurely study, spread over two or three years, without the overhanging storm-cloud of recurring examinations; and as a result a more cultured and, in the highest sense of the word, a better educated class of candidates for full training would be produced. As to the practical training of junior students in the methods and art of teaching, some people were much exercised at the loss of it. But under the new system the practical work would perhaps be less, but it would be supervised and directed. What the training lost in extension it would gain in intension; but care must be taken that the junior student was brought face to face with the actual problem of class management. Professional training meant more than practical training. The latter treated of the art of teaching; the former implied a knowledge of the psychological basis of education, as well as an acquaintance with the history of educational systems and theories. A proper relationship required to be established between the two. In their anxiety to get a scientific basis upon which to build, they might miss their mark altogether. What was wanted was practical experience, based upon and vitalised by a knowledge of theoretical principles; but the balance should be in favour of the former. I am of opinion that it is just here that the present regulations are likely to make shipwreck. There is not sufficient practical training, but it is perhaps premature yet to dogmatise.

The Training of Teachers.

IN view of the recent attempt of the Department by the introduction of a register to divide up the teaching profession into segregated groups, it was but natural to find a great deal of attention paid to the question of the solidarity of the profession. To Mr. Small, Vice-President of the Institute, was entrusted this important subject. He thought the new register had been instituted in a moment of temporary aberration, when the head of the Education Department had relaxed somewhat his usually firm grasp of the true function of a school. That function was not to give a modicum of knowledge convertible into cash on demand, but to draw out all the capacities of the pupil, to give instruction which would prove valuable to the child in any station of life which it might have to occupy. A teacher's interests were—first, good material to work upon; second, good tools to work with; and third, good time to work in. These interests were the same for all teachers, whether they were engaged in primary, intermediate, or secondary schools. The Institute, he said, was right in condemning a register which, in its opinion, would have the tendency to elevate the secondary school and to degrade the primary school. He was a firm believer in the doctrine that their best teachers should be in their primary schools. To teachers in intermediate and secondary schools he would say, "Do not be tempted away from our old ideal—the solidarity of the profession—and thus make shipwreck on the Scylla of self-interest." To teachers in primary schools he would say, "Do not, because of the difficulties which have been arbitrarily set within your path, be tempted away from those efforts after self-improvement which have been the chief glory of your colleagues in the past." And to all he would say, "Let us stand together, as of yore, firm in the conviction of the essential unity of our work and of our cause, pressing ever forward those reforms only which will result in lasting benefit to the children committed to our charge, the future citizens of this great empire."

The Solidarity of the Teaching Profession.

MR. D. M. COWAN, M.A., Glasgow, moved the following resolution with regard to superannuation: "That this Congress urges upon the Government the necessity for immediate improvement in the terms of pension for Scottish teachers." In doing so he said the demand of the teachers in this matter of superannuation was very moderate; they simply asked that the pension scheme should recognise some kind of proportion between the salary and the pension. It was quite possible that the proposal in the Government's last Bill might not be satisfactory all round; but if it were found not to work, it would be a matter of obligation on the Government to make it work all round. They could not expect to get everything at once. It had been said that small School Boards would not rise to the occasion. He believed, however, they would have the great mass of the School Boards on their side if they got the opportunity. They

Superannuation and Tenure.

should accept the goodwill of the Government as shown in the Bill of last year, and hope they would have only one more Bill, which would become an Act, and not simply remain a Bill.

I had the honour of submitting the resolution on tenure, which ran as follows: "That this Congress is of opinion that teachers should be protected against arbitrary and capricious dismissal." In proposing it I referred to the great feeling of disappointment experienced by all sections of teachers, but especially rural teachers, when it was found that in last year's Bill there was no mention of the question of tenure. Striking proof had been given during recent years of the necessity for some safeguard against arbitrary and capricious dismissal; and as a member of the Emergency Committee of the Institute, I was able to speak at first hand of the great extent to which in some quarters the teacher was harassed in the discharge of his duties. As a profession we only asked for the teacher who was doing satisfactory work protection against arbitrary dismissal for alleged, and sometimes not even alleged, reasons which had not the remotest connection with his professional work. I maintained that the creation of suitably large areas would go a great way to solve the problem. The question was not only a professional one, but an educational one. The teacher in the lonely side school, who was in greatest need of tenure, and who was doing as great a work as the teacher in one of the urban schools, should be allowed to do his work without fear of interference. This at present he could not do, and until and unless he had the opportunity the loss to education was immense.

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The Colour Characters of School Children.

A VERY extensive survey of the colour characters of school children in Scotland was made in 1904. An official account of this was promised, and Mr. J. F. Tocher, F.I.C., Peterhead, who had organised and directed the survey, gave some of the results at the Congress. Altogether, 2,288 returns have been made, containing the record of the colour characters and other particulars of 257,766 boys and 244,389 girls, a total of 502,155 children. The proportion of fair-haired persons in Scotland was small compared with North Germany—25 per cent. as compared with 80 per cent. Indeed, the distribution of hair colour in Scotland differed widely in every respect compared with Germany and Sweden on the one hand, and Italy and Switzerland on the other. The dominant colour among Scottish children was brown—the various shades of brown classed as medium. If brown was altogether a blend of fair and dark, then there was evidence of the formation of a new type in Scotland—the Scottish type. Some curious facts were brought to light by the survey, which suggested that red hair was not entirely or strictly a racial trait. It might have some peculiar physiological if not pathological connection.

The following are the statistics of the colour distribution of Scottish children:—

BOYS—EYES.

Colour.	Numbers Observed.	General Percentages.	Range in Counties % From	To
Blue	37,788	14·66	10·3	25·9
Light	78,140	30·31	22·7	33·7
Medium	84,334	32·72	27·9	34·4
Dark	57,504	22·31	17·4	24·4
Total	257,766			

GIRLS—EYES.

Colour.	Numbers Observed.	General Percentages.	Range in Counties % From	To
Blue	36,347	14·87	11·8	25·2
Light	74,068	30·31	24·1	34·8
Medium	78,357	32·06	26·6	35·8
Dark	55,617	22·76	15·9	26·3
Total	244,389			

BOYS—HAIR.

Colour.	Numbers Observed.	General Percentages.	Range in Counties % From	To
Fair	64,312	24·95	22·1	31·4
Red	14,162	5·49	4·6	6 9
Medium	111,569	43·28	37·3	49·5
Dark	64,511	25·03	18·7	30·8
Jet Black	3,212	1·25	·8	2·4
Total	257,766			

GIRLS—HAIR.

Colour.	Numbers Observed.	General Percentages.	Range in Counties % From	To
Fair	67,036	27·43	24·3	34·4
Red	12,435	5·09	4·1	6·8
Medium	99,873	40·87	35·6	47·4
Dark	62,073	25·40	19·4	29·1
Jet Black	2,972	1·22	·2	2·6
Total	244,389			

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Women as Teachers.

MISS MITCHELL, L.L.A., Edinburgh, dealt with this subject. After giving a short history of the introduction of lady teachers into the profession, she dealt with the selection, payment, and duties of mistresses. The outstanding points were that the girl who was to become a teacher should have good health, abilities above the average, and the wish to be a teacher. Women teachers had had a hard struggle to keep up their health in consequence of the enormous classes. The nerves both of the teachers and the children were in a constant state of tension. Even the teachers of infants should be cultured women. Too many girls wanted to be teachers because it was a genteel occupation. They thought the hours were short, but they did not take into account the home work and preparation. The most sweated section of teachers was the rural teacher, and especially the woman teacher in rural schools. She would put no man at the head of a girls' school, and no woman at the head of a boys' school. The co-education by men and women would be for the good of the children. She advised the women teachers not to fall into the common mistake of thinking that there was no limit to their strength, and that they could act as teacher, student, and housekeeper. Private study should not be overdone, and four nights a week and the Saturdays could not be given to classes if the school work was to be done satisfactorily.

R. D.

EDITORIAL NOTE.

OWING to extreme pressure on space, the Editor is reluctantly obliged to hold over a number of interesting and useful articles, including Mr. Wethey's helpful notes on geography. These and other papers of great interest will appear next month.

PICTORIAL ARITHMETIC.

BY HENRY WILKINSON, ASKEW ROAD BOYS' SCHOOL, GATESHEAD.

A STORY is told of one of H.M. Inspectors of schools, who, on visiting a Standard I. class, was asked by the teacher for his opinion respecting some problematic arithmetical questions written on the blackboard, and intended for the pupils to work. The inspector in a serious tone answered, "*I* could do them." Then in a tone more suited to his official position he added, "The pupils cannot *read* the questions set much less *work* them."

Given : Two chimneys, 69 feet high and 23 feet high.
Required : To find how much one chimney is higher than the other.
Construction : 69 feet − 23 feet = 46 feet.

With this in mind, see how reasonably a pictorial method may be applied to explain the above question to a lower standard, or even to an infant class.

From Fig. 1 it will be observed that *Given* is shown as a picture, and *Required* is stated in words. If the picture conveys its meaning, then no words at all are necessary. Examining Fig. 1 more attentively we find that :—

The first column shows the chimneys drawn roughly proportionate in height.

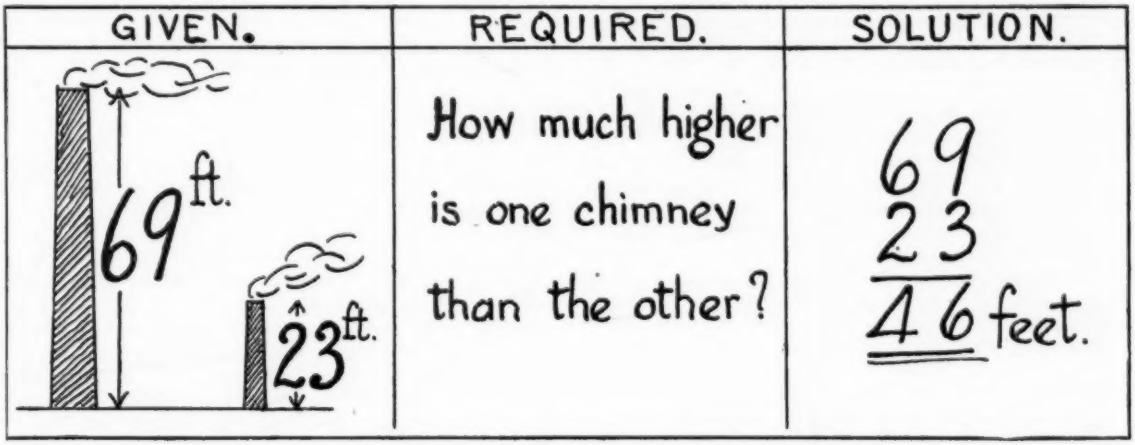


FIG. 1.

Though the story may not apply universally, still each teacher of a lower standard must from practical experience know the difficulty of stating an arithmetical problem in a few suitable words which the pupils can read and grasp intelligently. To overcome this difficulty the following method has been devised, and when adopted most satisfactory results have ensued.

It will be remembered that Euclid divides the enunciations of his problems into two parts—(*a*) that which is given, and (*b*) that which is required; or, written briefly, *Given* and *Required*.

In the second column—(*a*) the words give no hint that the question is a subtraction sum, and (*b*) they are arranged in lines suitable for correct phrasing in reading.

In the third column the Construction (or Solution) is seen alongside of Given and Required. Thus the pupil sees at a glance the whole of the sum from start to finish.

The words Given, Required, and Solution need not be written on the blackboard, nor be used with the pupils.

Previous to the pupils attempting the solution the following category on the part of the teacher is deemed advisable, as "the children should master the data

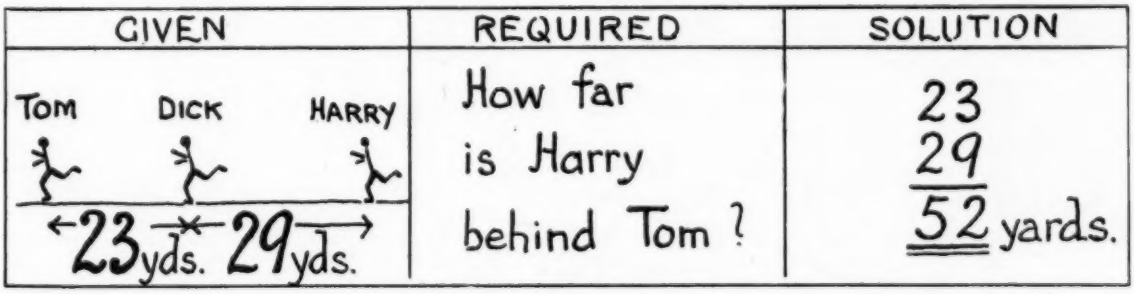


FIG. 2.

An arithmetical question may be similarly dealt with, and the following will serve as an example :—

A chimney is 69 feet high, another chimney is 23 feet high; how much higher is one chimney than the other?

Written according to Euclid's method, the question reads thus :—

of the problem, and have a clear knowledge of the reasons underlying the various steps." *

What have I drawn here? Two chimneys.
Name the height of the taller chimney? 69 feet.
What is the height of the lower chimney? 23 feet.

* *Suggestions to Teachers.*

Show me the higher chimney.
Which is the shorter chimney ?
What have you to find out ?

Here is another example. Expressed entirely in words, the question is written thus :—

Tom, Dick, and Harry run a race. Tom leads. Dick is 23 yards behind Tom, and Harry is 29 yards behind Dick ; how far is Harry from Tom ?

Imagine a pupil of a lower standard wading through all these words. By the time the little one has reached the end of the question he has forgotten the beginning of it ; and yet the question is so inviting, and one which boys especially would enjoy, as it is concerned with a race. Fig. 2 shows how the question arranges itself according to the method advocated.

In the first column we have—(*a*) the names of the boys ; (*b*) the distances expressed proportionately ; (*c*) only two numbers for an addition sum.

In the second column we have—(*a*) the words arranged in short suitable phrases, and (*b*) no hint that the sum is an exercise in addition.

The following are some suitable questions to be asked previous to the working out of the question, as "the aim of the teaching should be to make the children understand the reasons of the processes that they employ." *

How many runners are there ? Three.
What are they doing ? Running a race.
Name the boys. Tom, Dick, Harry.
Who leads ? Tom.
Who is second ? Dick.
Who is last ? Harry.
How far is Dick from Tom ? 23 yards.
How far is Harry behind Dick ? 29 yards.
What have you to find out ?

The teacher will here note that all except the last query may be answered from observing the picture only, and in this way the last question is systematically approached, for it is the most important of all.

Let us now consider the application of the method to division. In words the question will run thus :—

A roll of carpet contains 52 yards, and has to be cut into pieces, each piece 4 yards long ; how many such pieces can be cut from the roll ?

Arranged pictorially the setting-out will be :—

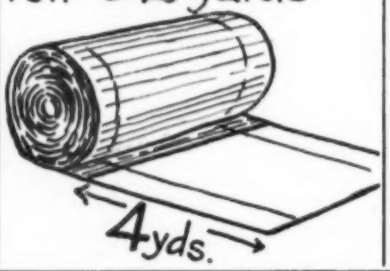
GIVEN	REQUIRED	SOLUTION
roll 52 yards 	How many pieces each 4 yds long can be cut from this roll ?	4 | 52 13 pieces.

Fig. 3.

The first column shows—(*a*) the roll of carpet ; (*b*) the length of carpet in the roll ; (*c*) the length of each piece to be cut off.

The second column—(*a*) arranges the words in phrases for reading ; (*b*) makes no mention that the rule is division, as "too much care cannot be bestowed by the teachers on the proper use of the technical terms of arithmetic, and the employment of these before the children are habituated to the processes which they indicate is to be deprecated." * (*c*) The words "*each* 4 *yards long*" are really superfluous ; the picture already shows the length of each piece to be cut from the roll.

The following questions are recommended previous to the working out of the sum :—

What have I drawn ? A roll of carpet.
How many yards does it contain ? 52 yards.
What is to be done with the roll ? Cut up into pieces.
How long has each piece to be ? 4 yards.
What have you to find out ?

(To be continued.)

* *Suggestions to Teachers.*

COMMON-SENSE HINTS ON THE TEACHING OF ARITHMETIC.

BY AN INSPECTOR OF SCHOOLS.

WE will at the outset suppose we are dealing with a class which has just left the infants' school, and has been transferred to Standard I. These children should be able to perform operations in the four simple rules with numbers up to 20 or 30. They should also be able to *add* and *subtract* in *tens :* say 30 and 30, 40 and 40, 50 and 30 ; 20 from 40, 30 from 80, and so on. For when a child can find out that 5 *ones* and 3 *ones* make 8, then there is very little, if any, increased difficulty presented to it in gathering that 5 *tens* and 3 *tens* make 8 tens or 80.

Some educationists may not agree with this last statement, but long and varied experience convinces the writer of its truth. For it is only a question of *denomination*, not an increase of difficulty in calculation ; and those who object would be equally logical were they to say that a question of "I have 5 *apples* and 3 *apples ;* how many have I ?" should not be followed by "I have 5 *oranges* and 3 *oranges ;* how many ?" Further, if this *idea*—and I use the word idea in its proper signification—be pursued, the scholars

* *Suggestions to Teachers.*

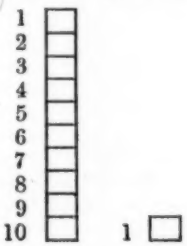
should calculate in *one denomination only*—whether apples, pears, plums, or what not. The absurdity of this requires no comment.

In these articles I shall leave *theory* severely alone, except reason compels me to show its futility, and deal only with *actual experience*. If the doctrine is to be laid down that a child should deal only with numbers it can *comprehend*, *apprehend*, or *realise*, then this dictum should apply with equal force and truth to schools for other children, and not be confined to the infants' school. I do not say a child realises what 80 is—how many adults do?—but if the child's vision is to be limited only to numbers it can really grasp, then the text-books on arithmetic, with, as a rule, their collection of excellent exercises, may be at once discarded, and the field for arithmetical survey will be very limited indeed. Because a child in Standard III. or IV. has a very vague and indefinite idea of £281, 14s. 1½d., should that child be deprived of the advantage it will derive in calculating the cost of 47 sofas at £5, 19s. 10½d. each? Other instances in other classes taking up different rules might be adduced in support of this argument, but it seems to me their citation would be a work of supererogation.

In the majority of infants' schools *mental* calculations only are the rule, and *written* work in arithmetic finds no place. This is as it should be. When I use the word *calculation* I employ it in its technical signification as utterly distinct from *counting*, the difference between the two being pointed out in the 1907 May number of the *Practical Teacher* in an article entitled "The Use of the Ball Frame."

Now it becomes necessary for the pupil on commencing written work to have some simple and interesting lessons on *notation*.

The question is, In what way should these be given? On the blackboard should be placed—



The children should be shown that the first column is *ten* times the size of the second one. Tillich's 10 brick and 1 brick may be used with advantage here. And in mentioning these bricks let me digress just for a moment to plead for their introduction into those schools where they are at present unknown. They are, in my opinion, far superior to the ball frame for the presentation of number. They represent it in the best form—namely, by *length* and *breadth*. And *equality* can be shown by their aid far better than by any other apparatus I know; for this equality can be ascertained by *building*, by *measuring*, and by *weighing*. On account of these two latter qualities they form an appropriate introduction to what is called by some educationists "practical arithmetic"—that is, an arithmetic in which the child becomes acquainted with weights, measures, etc., by the actual handling and using of them.

The teacher will show the difficulty and inconvenience of representing 10 by a column 10 times the size of 1, and the increased difficulty of representing 100 by a column 10 times the size of a 10 column, and this will lead him to talk of a "place value."

The children might be shown a sovereign and a shilling, and told to note carefully the size of each. This will best be done by the teacher, or, better still, the scholar drawing on the blackboard a diagram of each.

SOVEREIGN.

SHILLING.

They will observe that there is not much difference between them as regards size. Yet it will not be a very difficult matter to lead them to see, if they already do not know, that the value of a sovereign is 20 times that of a shilling, and this because of the superior value of gold to that of silver.

It can then be pointed out that the value of a figure depends on its *place*. Thus 1 = 1, but if another

1

is placed on the left hand side of the first 1, thus—

11,

the 1 last placed down has the value of a 10; and if another 1 is placed in front of these, thus—

111,

this last one put down takes from its position the value of 100. From this the scholar is led to see that a single 1 stands for a single, and any single figure, such as 8 or 9, stands for 8 or 9 singles; a second figure placed to the left of this "singles" figure becomes, on account of its place, a "tens" figure; and so on with the "hundreds" figure. The figures may now be labelled for the *first* lesson, and *for the first lesson only*, thus—

H T U
1 1 1.

It is absolutely unnecessary and perfectly absurd that a child should go on labelling these figures, as is sometimes the case, all the year round.

To press this home some such exercise as the following may be given with advantage:—

1. Read 111—one hundred and eleven.
2. What does the *first* one stand for? 1 hundred.
3. What does the *second* one stand for? 1 ten.
4. What does the *third* one stand for? 1 single.
5. Take the *third* 1 from the *second* 1. What is left? 9.
6. Take the *second* 1 from the *third* 1. What is left? 90.
7. Take the *third* 1 from the *first* 1. What is left? 99.
8. Take the *second* and *third* 1's together from the *first* 1. What is left? 89.

[I am indebted to Messrs. Thomas Nelson and Sons for the privilege of taking this example from their *Continuous Mental Arithmetic*.]

This might be succeeded by the following addition sum placed on the blackboard:—

```
1 2 3
  6 5
2 0 4
4 2 1
  1 3
-------
7·11·16
```

One child is asked to come out and point to the "hundreds" line, another to the "tens" line, and a third to the "singles" line. Then the addition is made, and the child reads the answer thus :—

7 hundreds, 11 tens, 16 singles.

The hundreds, tens, and singles may be then treated as standards in a school, and it will not require much ingenuity to show that the 1 *ten* in the "singles" column should be transferred to its proper standard, the "tens" column, and the answer read—

7 hundreds, 12 tens, 6 singles.

The 1 in the "tens" column will be similarly treated and transferred to the "hundreds" column, and the answer read—

8 hundreds, 2 tens, 6 singles,

or 8 hundred and twenty-six.

The child will thus see that the carrying of figures is really for the purpose of classification.

Lessons framed on these lines will do away with the utterly absurd practice of crossing out the figure to be placed in the line, thus 16. I say utterly absurd, for if the child knows which figure to cross out, it also knows equally well the figure to be placed in the line.

The next step will be to imagine we have 5 fields with the number on each line representing so many sheep in each field. We will take the example previously worked—

1 2 3
6 5
2 0 4
4 2 1
1 3
8 2 6

This gives us 826 sheep in the 5 fields.

Now the attempt should be made to put these sheep in 4 fields instead of the 5.

And the first step is to draw a line round the figures 1, 2, 6, 2, and the child led to see that he has enclosed in his field 380 sheep—thus—

1	2	3
	6	5
2	0	4
4	2	1
	1	3
8	2	6

380

A second line is drawn round the figures 4, 0, 5, 3—thus—

1	2	3
	6	5
2	0	4
4	2	1
	1	3
8	2	6

408

and the child asked to say how many sheep are enclosed by this line—namely, 408.

A third line is then placed round the 1, 2, and 4—thus—

1	2	3
	6	5
2	0	4
4	2	1
	1	3
8	2	6

34

and the child induced to say that the number of sheep enclosed by this line is 34.

Lastly, the remaining figures 3 and 1 are enclosed, and the result is 4.

Now the class will total these four results—

3 8 0
4 0 8
3 4
4
8 2 6

When it sees that the number in the 4 fields is the same as that in the 5 fields, interest will be aroused and attention stimulated.

Other exercises might follow, in which the sheep in 5 fields are placed in 6 fields or in 3 fields—that is, the number of fields may be *increased* or *decreased*. This training should give the children a very good idea of notation.

The blackboard has been used for all these exercises, and the child has done nothing on paper or slate, and it is advised that in the lower classes most of the lesson be taken up with the blackboard teaching, and only so many exercises worked by the children as will enable the teacher to see how far his teaching has been successful. (*To be continued.*)

NATURE NOTES FOR THE MONTH.

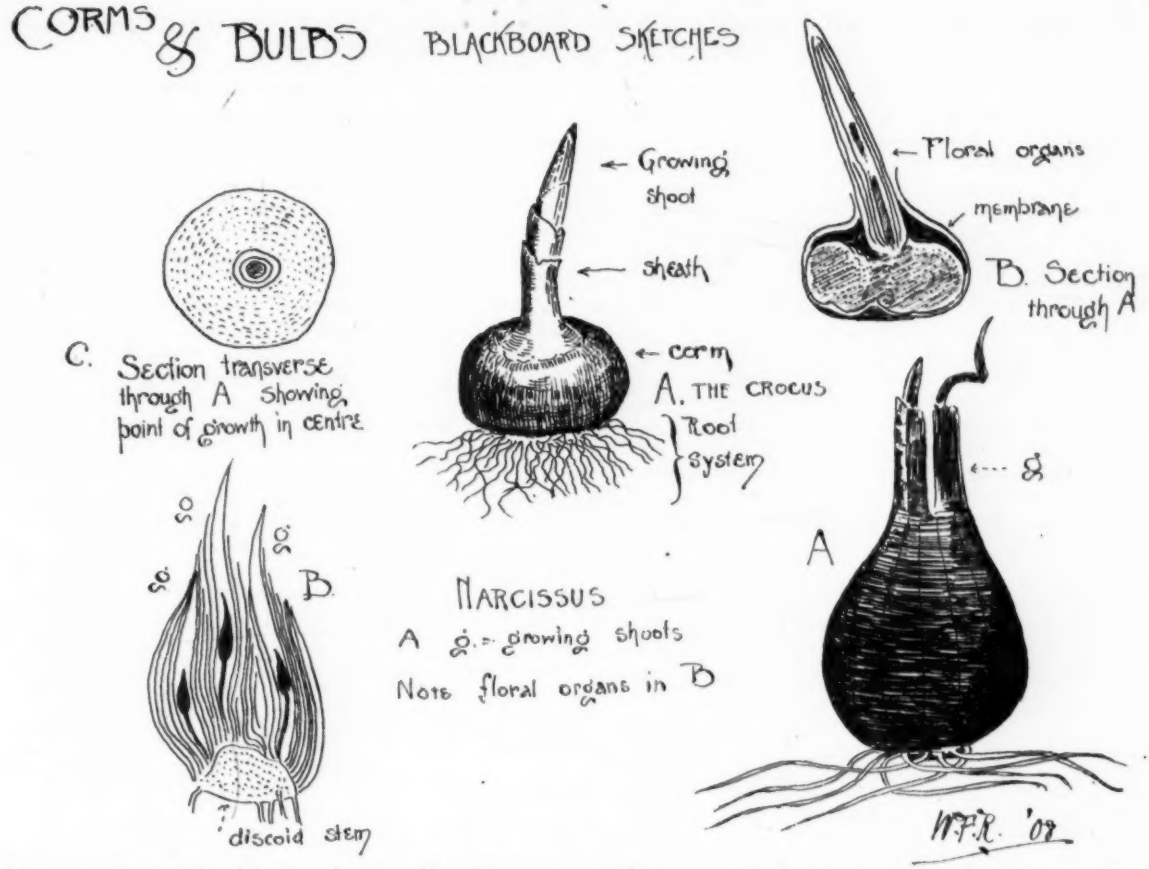
BY W. FRANCIS RANKINE.

FEBRUARY.

"February, fill dyke or ditch
Black or white—no matter which."
Old Country Saying.

THIS distich may correctly express the desires of those whose thoughts are directly concerned with the conditions that secure successful crops, yet to the majority of people February weather is not of the kindest. By the calendar it should be the month of heavy rain and driving sleet that usher in the searching winds of March; but usually its weather is variable, and mild days are not infrequent. Fickleness is the keynote of the month. In the latter part of the month the lark's song may be heard, although the sky be dull. Incongruous it is, yet none the less welcome as a herald of the days in store when the warming sun shall awaken spring life. On the warmer days, when the winds lull and the sun breaks through awhile, many hibernating butterflies are enticed from their winter retreats. There is an untold pleasure for the nature lover who watches the half-torpid brimstone or tortoiseshell butterfly enjoying a short flight through the sun-warmed lane. Yet treacherous days are these, and long ere sundown the insects drop one by one into the undergrowth of hedge and copse. Strange as it may seem, there are moths to be obtained during this inclement month; nevertheless, they are rarely seen. Perhaps the conspicuous oak beauty may be taken at rest in the wood, while the brindled beauty and March moth avail themselves of the usefulness of protective colouring as they cling to the sheltered side of lichen-covered tree-trunks.

Of flowers there are few, unless the weather has been exceptionally mild. Then the protected banks in the



lanes are decorated with the glossy golden blossoms of the lesser celandine, and the waste lands are carpeted with the yellow coltsfoot. The wild arum commences to adorn the banks and hedgesides with its luxuriant sombre foliage. On the sheltered borders of the garden the crocus, snowdrops, and Lent lilies are steadily advancing their tender, sheath-protected leaves.

The woods are silent in their winter sleep. The bareness of the trees reveals characteristic shapes and growths, and in protected glades the winter buds are well advanced. Often the rigour of the weather forces the rarer birds to come nearer to our doors, and so we enjoy the twofold pleasure of feeding and observing them. In the lane, where the elms are thickly clad with ivy, flocks of fieldfares are obtaining food from the ivy berries. With them are the redwings that also have wintered south on account of the severity of the weather in their Scandinavian homes. Where the scarlet berries still remain on the holly and yew the missel thrush is greedily searching for food, and in the open fields near the pond are the lapwings that have come up from the frozen marshes. This indeed is a serious time for the birds, and great activity exists among them in order to obtain food. Many useful observational lessons are thus obtained, and in severe weather there is ample material for such lessons in the frozen bodies of the smaller birds that are brought to the schoolroom. Last February I recall that several of these victims of the severe frosts were brought to me, and chief among them were chaffinches, blue tits, and the fragile golden-crested wren. The tragedy of the ending, the search for the food that was not forthcoming, can only be matters of conjecture, yet they serve the useful purpose of awakening deep and true sympathy in the hearts of the children.

Scheme of Work for February.

In nature teaching February is often regarded as one of the "dead months" of the year, yet to the observant it is evident that a great amount of material is available. The following is a tabulation of suitable subjects for lessons :—

(A) *Trees.*—The bareness of the trees reveals characteristic shapes and habits of growth. Direct observations should be made, and photographs are excellent auxiliary aids. The sequence of this work should be secured by the study of (*a*) buds in March and April, (*b*) leaves in June, (*c*) tree fruits in August, and (*d*) leaf change and fall in September and October. The plan of the lessons on trees should embrace observations on (*a*) the tree, (*b*) habitat, (*c*) growth, (*d*) branching, (*e*) twigs, (*f*) bark, (*g*) timber. It should be noted that the growth of the twig is generally characteristic of the parent tree. Material for lessons on this subject is appended.

(B) *Corms and Bulbs* (food storage).—It is the practice in many classrooms to grow specimens of this class of plants in the view of the scholars. This secures excellent material for observational lessons. Records of measurements of growth, with drawings of the phases of development, should be kept. The chief points of these lessons are :—

(*a*) Corms. Modified form of stem with the power of assimilating food after the plant has blossomed.

The crocus is a type. Note the formation of a new corm each year, and the wasting of the old one as growth develops.

(*b*) Bulbs. Stem modification. The lilies afford examples of *scaly bulbs*, and the onion is a type of the *tunicate bulbs*. Formation of *bulbils*.

(*c*) Cut sections through corms and bulbs that have commenced growth, and the completeness of the floral organs is seen. Grow a hyacinth in a glass jar containing water, in order to demonstrate the utility of food storage. The finest example of this is afforded by the monarch of the East, which will blossom if it be placed in the light. The root system of the corm and bulb should be carefully examined.

(C) *Weather Observations.*—The study of weather is often omitted from the nature study scheme, in which it has a legitimate place. It is probable that few subjects present such opportunities for observation of effects and discovery of cause. Further, weather observations may be carried on throughout the year, and thus records of interest and educational value are secured. Records should be made of rainfall, direction of wind, and cloud forms. Material for lessons on clouds will appear next month.

Material for Observational Lessons on Trees.

The leafless condition of the deciduous trees affords an opportunity for observational lessons on their shapes and habits of growth. Each species of tree possesses an individuality in shape, growth, mode of branching, and character of bark. These may be noted during the school walks in wooded districts, and the contrast between the summer and the winter conditions of tree life should be observed.

The following observation table on trees in winter is offered as an indication of procedure. In addition to the species there given there are other interesting subjects for study—namely, hazel, willow, sycamore, hornbeam, and ash. The material for these lessons is easily obtainable in most districts, and should consist of well-developed twigs and pieces of bark. Also, if it is possible, polished and unpolished sections of the most useful woods should be collected. These form a useful addition to the school museum.

OBSERVATION TABLE.

Tree.	Habitat.	Growth.	Branching.	Twigs.	Bark.	General Notes.
Oak (*Quercus robur*).	Flourishes on strong clay. It is well distributed.	The growth is very robust.	The branches grow from the main stem irregularly.	The twigs are strong, and grow out from stem in every direction.	The bark is deeply furrowed, and is dark in colour.	The oak is the strongest of our forest trees, and when free to develop it will extend over a large area. The trunk is erect, and breaks at intervals into strong branches. It lives to a great age, and furnishes excellent timber.
Beech (*Fagus sylvatica*).	Flourishes on chalky soils, and is well distributed.	The growth is handsome and very symmetrical.	The branches are slender and long.	The twigs are straight and slender, and grow out at an angle of about 60°.	The bark is smooth, and light in colour.	The beech is one of the most handsome of forest forms. The trunk is strong, and throws out long, crooked branches.
Birch (*Betula alba*).	Grows well on well-drained soils.	Extremely graceful.	The branches interlace, and are very long.	The twigs are long and slender, and grow out at an angle of about 45°.	The bark is silvery white. It peels off in strips.	From its graceful habit the birch is worthy of its name, "The Lady of the Woods." It is an extremely favourite tree, and adds to the beauty of sylvan landscapes.
Poplar (*Populus alba* and *nigra*).	The poplar thrives well in any position.	Erect and towering.	Thin, and growing upwards.	Slender.	Rough, and dark in colour.	The poplar grows to a great height, and is a distinctive feature in level districts. There are few side branches of any great size. The tree is supple, and sways in the lightest breeze.
Elm (*Ulmus campestris*).	Well distributed.	Upright and strong.	The branches are strong and far reaching.	The twigs are strong and rather drooping.	Well ridged, and dark in colour.	The elm is a tall tree, and is a prominent feature in English scenery. It provides useful timber.

Application.—Trees form the most conspicuous objects of landscape pictures, and have provided favourite themes for the poets.

Thus Spenser in the "Faerie Queen" refers to the

(*a*) *Oak*—"The builder oak, sole king of forests all."

(*b*) *Beech*—"The warlike beech."

(*c*) *Birch*—"The birch for shafts."

(*d*) *Poplar*—"The poplar never dry."

(*e*) *Elm*—"The vine prop elm."

Cowper alludes to the *sycamore* thus :—

> "The sycamore, capricious in attire,
> Now green, now tawny, and ere autumn yet
> Have changed the woods, in scarlet honours bright."

NEXT MONTH

The Editor hopes to present a special review of

DR. SADLER'S VOLUME ON CONTINUATION SCHOOLS.

Our Art Section.

SOME WELL-KNOWN BRITISH MEZZOTINTERS.

I.—RICHARD EARLOM.

BY W. E. SPARKES.

What is a Mezzotint?

READERS of newspapers unacquainted with the various kinds of engraving are often surprised at the prices paid for choice examples of mezzotint put up for sale at Christie's from time to time. These prices frequently run into hundreds of pounds, and the astonishment of the reader is increased on learning that, originally, the plates were sold for two or three guineas. No doubt these inflated values are due to the fashion of the moment, which has determined to regard mezzotints as the most valuable of all forms of engraving. For art has its periods and its fashions. Forty years ago great line engravings were all the rage, and this was followed by an equal rush for choice etchings.

But there is really a daintiness as well as a strength in mezzotint not to be found in any other method of reproduction. Moreover, it is not an ancient art, whereas both line engraving and etching have been practised by the greatest artists for several centuries. These latter forms, however, differ little in essence, for they are produced by inscribing lines into a metal plate, which said lines being filled with ink give an impression on the paper when subjected to great pressure.

On the other hand, a *pure* mezzotint consists entirely of a multitude of extremely fine dots, so small as to be generally invisible without the aid of a magnifying glass. I propose to show simply how these dots are obtained.

Suppose one takes a plate of soft metal, such as copper or zinc, over which one rolls with much pressure a toothed wheel set in a handle. Evidently the teeth will dig small pits in the plate, and if the finger is carried across the copper, a slight roughness caused by the upstanding edges of these tiny pits will be felt. Now if ink is rubbed over such a plate, and then a rag carried across it from side to side, these little edges will retain the ink, so that if a plain sheet of paper is pressed upon the plate, each little edge or *burr* will be printed as a more or less regular dot. Multiply these dots so as to cover the plate in every part, and it is evident the whole plate will print as one solid black, though a powerful magnifying glass might detect little points of light between the dots in every part.

It is, indeed, thought that the first mezzotint plates were prepared by passing such wheels across the copper or zinc; but it was soon apparent that some better means was necessary, so that early in the history of the art another and more efficient instrument was invented, and one which serves its purpose admirably. It consists of a steel plate with numerous grooves, the edges of which naturally end in sharp points. A great pressure can be exerted from the handle. It is rocked from side to side, and is made to travel across the plate in fifty or sixty different directions, until the whole surface is covered with an infinite number of dots.

As pointed out above, such a plate would print quite black because of its *burr*. But now if a sharp scraper is carried over any portion it will scrape away some of the upstanding burr, and such a portion will not hold as much ink as before. That is to say, the resulting print from those parts would be lighter than elsewhere, until, if all the burr is cut away, it would print quite white. Evidently any number of gradations of black and white can be obtained by scraping away more or less burr where necessary, so that, in fact, it is possible to copy the most delicate shades; and the finest mezzotinters have carried the art to the most astonishing degree of excellence in this particular.

The Invention of Mezzotinting.

One hardly associates the soldier with the artist. It is too readily assumed that the artist is a somewhat effeminate person, unable to rise to sterner moods in life. Yet Michael Angelo and Leonardo da Vinci were keenly interested in war; both were excellent engineers, and both were consulted when the question of fortifying cities in those strenuous times was a thing of vast importance. And the most artistic nations in history—the Greeks and the Japanese—may be given as instances of peoples able to pass readily from the soft delights of art to the most heroic deeds in defence of the fatherland. The Greeks, who rolled back the Persian invasion in the fifth century before Christ, built that marvellous temple, the Parthenon, and left artistic remains which are still the delight of cultivated intelligence; the Japanese have always been a nation of fighters, and never more so than when they surrounded themselves with the daintiest and most beautiful transcripts from nature in line and colour.

And who would dream of "fiery Prince Rupert," the hot-headed soldier who fought so vigorously on behalf of his uncle, Charles the First, as a cultivated and sensitive artist? Yet from that most unlikely source mezzotinting took its rise in England. It is true he did not invent the art, but learnt it from another soldier in Holland, Ludwig von Siegen, who was undoubtedly the first to practise it. At that time the Dutch were among the most artistic nations in Europe. They had, a short time before, heroically fought and conquered the great Spanish power in defence of the fatherland. A strenuous and brave people, they had at length leisure to pursue art in all its forms; high and low alike were intensely interested in painting, architecture, etching, and engraving. It would be too long a story to recount here how deeply European, including British, art in landscape and portraiture was influenced by this Dutch movement. Suffice to say art was encouraged at all the courts. The Dutch Landgrave and Charles the First were noble patrons of art.

Ludwig von Siegen appears to have been art master to the young Landgrave, William the Sixth; but in 1638 he gave up the appointment to settle in Amsterdam, where he continued to study and practise art.

In 1642 he sent a portrait of the Landgrave's mother to William the Sixth, done in an entirely new mode of engraving. It was, in fact, an excellent mezzotint. Every one was interested, but Von Siegen kept his art profoundly secret. The fact that none of his earlier efforts have come to light leads one to believe that he utterly destroyed all his immature attempts until he had perfected his art, for the portrait of the Landgrave's mother is very complete in technique.

Perhaps the secret would have died with him if chance had not brought him in contact with Prince Rupert in 1654. The royal cause had failed; Charles the First had been executed, and Prince Rupert was wandering about Europe as a soldier of fortune. His rovings brought him to Brussels in 1654, where he met Ludwig von Siegen, then lately promoted to be a major-colonel in the Dutch army. Community of tastes brought the two men together, and doubtless this led Von Siegen to show his art of mezzotinting to the prince, who was not long in mastering its mystery. A magnificent plate by him soon became famous. This was a mezzotint measuring about 27″ × 18″, a copy of Spagnoletto's painting of the executioner holding John the Baptist's head. This plate—the "Great Executioner"—is in the British Museum. It is among the finest and most spirited mezzotints that have ever seen the light of day. The impetuous soldier is reflected in the dashing sweeps of the scraper; the lights and shades are magnificent. On the executioner's blade is the legend, "R. P. F., 1658"—that is to say, "Rupert Prince fecit, 1658."

In 1660, with the restoration of Charles the Second, Prince Rupert was recalled to England. Honours were showered upon him. He settled at Spring Gardens, London, but unfortunately he gave up mezzotinting to study hydraulics and the making of gunpowder.

The gentle John Evelyn, however, was just then turning from his beloved gardening to write a book on a subject interesting in those days to most cultured men—the study of art, and especially of engraving. He wrote a capital book on the subject, and was initiated by the prince into the mysteries of mezzotinting. In fact, the prince worked a plate for him—the so-called "Little Executioner," because it consisted of the head only of his large plate worked in 1658.

From that time onwards the art progressed by leaps and bounds. At no time was there a single break in the continuity. Each year saw new experiences, new experiments, and fresh successes. Mezzotinting became supremely a British art; for the foreigners who practised it must needs come to England to learn the process.

What is known as the *great period*, however, lay between

"Fruit and Flowers." A Mezzotint by Richard Earlom.
From a painting by Jan van Huysum.
(Photo by W. Rice.)

"Pastoral Scene." A Mezzotint and Etching by Richard Earlom.
From one of Claude Lorraine's plates from his *Liber Veritatis*.
(*Photo by W. Rice.*)

1770 and 1800. It is from the mezzotinters living in those years that a selection has been made for the following papers.

Richard Earlom.

Born in 1743, Richard Earlom early showed a taste for art. When still a boy, the Lord Mayor's carriage, with its dainty panel-paintings by the fashionable Italian artist Cipriani, was brought for repairs to the house where Earlom was apprenticed. Charmed with the paintings, he copied them with such success that it was decided he should become an artist, with which end in view he was sent to Cipriani. He progressed so rapidly that at the age of twenty-two he was employed by the celebrated print-seller, Boydell, to copy in mezzotint many of the paintings belonging to Lord Houghton.

But he was a versatile artist. All was grist that came to his mill. With equal success he mezzotinted Hogarth's paintings, the Old Masters, and Claude's drawings, about which I shall have a few words to say. Among all the clever mezzotinters then living he was distinguished not so much for his vigour as for his delicacy and truth, whether in expressing shades or textures or in capturing the feeling which lent charm to the painting he was translating in another medium. In this he proved conclusively that the mezzotinter is far more than a mechanical copyist, for one must remember he had to consider not merely the outlines, but also the tones and colours. It is not an easy matter to decide what depths of light and shade shall fitly translate reds, blues, yellows, and the innumerable broken tones that go towards a satisfactory harmony in colour. No better example of his success could be selected than the flower piece here reproduced, and which is certainly among his masterpieces. No engraver in line, no etcher, and no mezzotinter had ever accomplished so fine a translation, preserving the very spirit, the exquisite delicacy in outline and texture, of the original painting. Think for a moment that all these delightful qualities were to be gradually brought out from a copper-plate covered with an infinite mass of fine dots, so closely placed that the first printing would give merely a deep, dull, black mass, across and about which the sensitive scraper was carried with the most minute and loving care, so as to preserve the outline, the colour, the atmosphere, and the thousand and one excellences that should lose nothing of the balanced refinement so characteristic of fine blooms and fruit. That Earlom was supremely successful in these accomplishments in such a difficult subject is acknowledged by all.

"Fruit and Flowers." By Jan van Huysum.

During the seventeenth and the early part of the eighteenth century the Dutch were passionately given over to flower culture. At first tulips and hyacinths were the rage, but afterwards a more catholic taste prevailed, and flowers of all sorts were cultivated. At the same time Dutch art had shown an amazing freshness and originality: portraits, landscapes, paintings of architecture, and, lastly, still-life, were all alike excellent in feeling and in workmanship.

It is not strange then, when one considers the craze at that time for fine flowers, to find a school of artists devoting themselves to painting flower-and-fruit pieces, and exhibiting wonderful skill in catching the delicate texture of petals, the interplay of choice colour, and the stately freshness and charm proper to fruits and blooms.

Van Huysum is said to have received the finest flowers from wealthy amateurs, who were proud to see their garden products bloom again on the canvas of an artist then and now known as the "Raphael of flower-painters." The title was a just one; for Van Huysum selected flowers and fruits without a suspicion of decay, the highest of their kind, what one might call *ideal* in form and colour, exactly as Raphael had covered his canvases with men and women too perfect in shape and action for this workaday world. For both artists deliberately set themselves to contemplate a perfection such as one might imagine proper to those countries and times so dear to poetry —an Arcadia where the sun is always shining upon a kindly soil, which gives the most noble fruits and flowers freely and generously to happy peasants passing their time in simplicity and ease.

And this "Raphael of flower-painters" deserves the title, not only for his selection of stately types, but quite as much for the nobility of his grouping—a generous richness and studied elegance in disposition. His paintings have much the same effect on us as a landscape of thick-foliaged trees under a deep sky through which fine-rounded clouds sail slowly. These blooms are no dried specimens from a botanist's collection vivified into life by the magic of a painter's art, but they are freshly cut from a garden where there are fruits and flowers growing in careless abundance. They are so recently gathered that the dew-drops still rest on them here and there; butterflies hover over them while they still retain the odours of the garden.

And when one considers the skilful massing in colour, the gradations in tone from the deepest shade to bright light, the added graces to this richness in form and composition, one begins to understand the delight that artists and lovers of flowers alike find in Van Huysum's flower-pieces. The amazing patience with which Earlom has translated the forms and colours from this painting into mezzotint, the absolute truth in drawing, would alone make it valuable as a specimen of craftsmanship; but it is much more than that. The Dutch painter must have loved flowers for themselves, and not only because they gave him an opportunity to make pictures; and Earlom's supreme gift seems to me to be his power of steeping himself in the feeling proper to each painting that he set about translating into mezzotint. When he copies Hogarth's "Marriage à la Mode" he becomes a satirist for the time being; if it is an Italian painting, a Madonna and Child, he is at once ecclesiastical; while a flower-piece finds him deeply interested in blooms, and entering into the painter's enthusiasm by his gift of sympathy.

For these mezzotinters were artists in feeling. The accidents of the time decided their way of life, but many among them were far removed from mechanical craftsmen. Indeed, one could point out instances where the mezzotinter has converted a poor painting into a graceful work of art.

A Plate from Claude Lorraine's "Book of Truth."

A comparison of this picture with Van Huysum's flower-piece suffices to show how wide is the range covered by this process of mezzotinting. The one consists of the most delicate gradations in shade touching every note of the scale: the other has a few firm lines enriched by simple washes. And each admirably reproduces its original.

Claude Lorraine was the most celebrated landscape painter of the seventeenth century. A Frenchman by birth, his works were treasured by European collectors everywhere, and a busy and hard-working tribe set themselves industriously to copy his style, in order to palm them off on the innocent as genuine works by the master.

This fraudulent proceeding at length became so intolerable that Claude drew up a sketch-book containing the outlines and the general effect of his paintings. On the reverse side he wrote the title, the person for whom the painting was made, and the present owner. By such means he hoped to frustrate the wily copyists, who had multiplied Claudes to an unconscionable extent.

After his death this sketch-book passed from hand to hand, finally resting with the Duke of Devonshire at Chatsworth. It was considered so exceedingly fine that the duke was prevailed upon to allow copies to be made for the general public. To this end Earlom, as the most intelligent translator, was called in to reproduce the sketches in *facsimile*. As Claude had first drawn the outlines with a pen and then had added washes in brown for the shades, Earlom in the first place bit the outlines into the copper plate by etching, and for the washes employed mezzotint—a plan so supremely successful that his work became at once a classic.

As always, Earlom caught the very spirit of the artist. The lines are free, strong, and flowing; the shades range with a swift movement from intense dark to silvery light. No wonder Claude's *Liber Veritatis* (the Book of Truth, so-called because it tested every pretender) was welcomed universally, for thousands of amateurs have first become acquainted with the great Frenchman by way of these mezzotints.

In these sketches Claude's power is faithfully reflected—the power to see and to express nature in her calmest moods. The scenes are bathed in light and softened by atmosphere, and the refined treatment is not more evident than that romantic outlook which sees in ruined temples or in massive and precipitous rocks other interests to carry a common scene into the regions of poetry. Later art dubs this artificial, conventional; it leaves Nature to tell her own story. But Claude lived at a time when the artist studied effects closely, and copied them faithfully, only to make use of these studies as elements in a new scene, separate notes to be combined in a new harmony, the stuff and material out of which to weave scenes that exist only in the imagination.

It may be safely said that no such view as this pastoral scene lived in reality. Claude had taken a stream here, and trees there, and rocks from another place, and with these as the pieces in his hand, he had arranged a delicate mosaic delightful for its beauty and pleasant for its ingenuity.

There were two hundred sketches reproduced by Earlom in

mezzotint, so one can easily gauge Claude in one particular at least, so far as regards his imagination; and it may be said at once that, delightful as the individual parts are in almost every case, he was not altogether satisfactory in combining the parts. I call to mind one plate after another in which there are several groups in the foreground, all supremely indifferent to what is taking place around them, and detached in interest, as if they were so many puppets on a boy's pasteboard theatre.

Perhaps this was inevitable. Still, even these blemishes (as they are universally agreed to be) do not destroy the exquisite drawing, the fine shades, and the delightful feeling of open air in almost every plate.

And what shall be said of the mezzotinter who could capture this excellence? Richard Earlom is a name to conjure with. Of late years mezzotint has revived as an art, but through all the long roll of names there are few which can stand beside his for versatility and for the power to interpret the moods of artists so diverse as Hogarth, Van Huysum, and Claude Lorraine.

THE CERTIFICATE EXAMINATION, 1907.

DRAWING.

Methods of Teaching and Illustration.

December 5—4.30 to 5.30.

(A sheet of diagrams is to be given out with this paper to each candidate.)

BEFORE commencing your work, you must read carefully the following instructions:—

All your drawings and answers must be made on the sheet of drawing paper supplied; no second sheet will be allowed. You may use both sides of the drawing paper, and answer as many questions as you can; but every candidate is expected to attempt Questions 1 and 2. Questions marked (*) have accompanying diagrams. Close to your drawings and answers write clearly in large figures the numbers of the questions to which you refer.

It should be borne in mind that a drawing done in a direct, simple, and careful manner is better than one which is confused and has been hurriedly done.

Mathematical instruments must be used for the drawing to scale (Question 5), and all lines used in construction must be distinctly shown. A single accent (′) signifies feet, a double accent (″) inches.

Q. 1.* Suppose the diagram to be the subject of a lesson in drawing in outline. Show by means of a series of sketches the steps which should be taken in making the drawing.

Make a drawing, such as might be used for the illustration of this lesson, to show (*a*) how far the ornamental form in the diagram has been inspired by a study and knowledge of nature; or (*b*) how the knowledge of some similar decorative form may have provided a suggestion for the ornamental arrangement of the spray.

Draw also an object to which the decorative form in the diagram might fitly be applied, and show the decoration in position.

Select what you consider to be one of the most beautiful features of the diagram, and give your reasons briefly, and with explanatory sketches, for thinking it beautiful.

Q. 2. A lesson on the drawing of a simple rectangular box in outline is to be given to a class of twelve scholars seated at movable single desks. Show by means of a sketch plan how you would arrange the scholars, the box, and your blackboard.

Supposing the lesson to be of an hour's duration, and the scholars to be of varying attainments and ability, say how you would secure that each individual should receive the amount of instruction necessary to ensure due progress.

Indicate by means of a series of sketches the steps which should be taken in making the drawing of the box.

Make a drawing such as might add an element of vitality to such a lesson and enlarge the scholars' outlook of some piece of furniture, architectural structure, or natural form, etc., in which some of the principles involved in drawing the box are exemplified.

Q. 3. State briefly how you would illustrate a lesson on one of the following subjects, making use of sketches in your statement:—(*a*) a cow, cat, duck, or swallow; (*b*) the growth of a buttercup, daisy, crocus, honeysuckle, oak, holly, maple, or ash; (*c*) modes of transit.

Q. 4.* Make a copy of the coloured pattern with brush and colour. The parts of the pattern may be first indicated with the pencil.

Q. 5.* A dimensioned sketch of a coffer is given. Make a drawing of the coffer with instruments to the scale of $1\frac{1}{2}''$ to $1'$, and indicate clearly, by means of letters (A, B, etc.) or by written explanation, the steps taken in the construction of the drawing.

Q. 6. Describe in general terms a course of drawing which you think suitable for a public elementary school, including an infants' division.

Last year an important step was taken by the Board of Education. At last the importance of right methods in the teaching of drawing and the necessity of training teachers to use these methods with skill and intelligence were admitted by the issue of a comprehensive syllabus. The examination paper printed above is the first to be set on the new syllabus. As will be seen, the paper is of wide scope, and tests every section of the work. It includes the teaching of drawing from objects, brushwork, drawing to scale, the illustration of lessons on the blackboard, and the drawing up of courses of work. Curiously enough, the test is much more severe than that applied to students in training colleges, where the inspector merely examines a sample of the students in drawing on the blackboard, and inspects the drawings on paper.

The first glance at the paper shows what a rich field the examiners have to draw upon. They have not had to avoid questions set in previous examinations. This perhaps accounts for the congested look of Questions 1 and 2, which have each four sections, and are compulsory.

One can hardly read the questions through without being amazed at such a paper being handed to candidates who had

Question 1.

only a bare hour in which to deal with it. An experienced art teacher, working at top speed, could not get through the first compulsory question in the hour, and the examiners' note that "a drawing done in a direct, simple, and careful manner is better than one which is confused and has been hurriedly done" sounds cruelly ironical. Nothing could be more calculated to cause confused and hurried work than such an overloaded examination paper. The time allotted should have been at least four hours, and nothing can excuse the examiners who deliberately set such a paper, the mere reading through of which was likely to cause dismay in the mind of the students. Some of the questions are good, but they are not too simply worded, and demand some little time spent in thinking out what the examiners required.

What the answers could have been like under mental conditions of confusion and dismay can be easily imagined. Probably many of the candidates never got beyond the first question. The examiners will meet their punishment when they come to struggle with the papers of answers. Their report will be awaited with great interest, both by the candidates and their art teachers.

On studying the questions in detail, it will be noted that the diagram in Question 1 is far too small. Candidates who puzzled over it while trying to answer the four sections of the question must have fatigued their eyes.

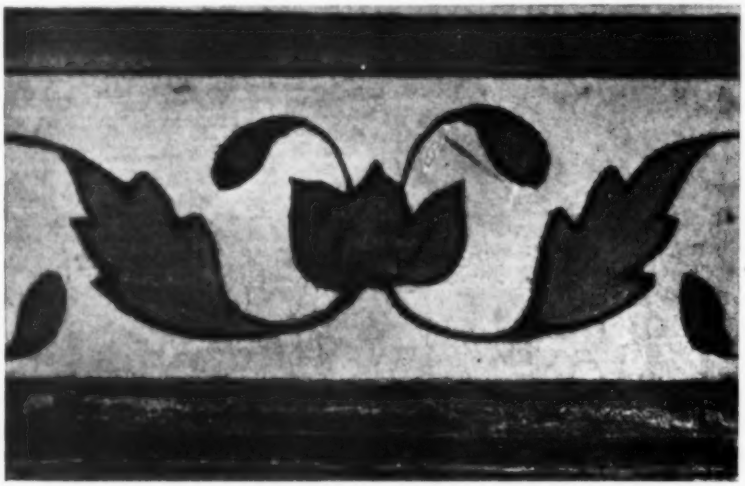
The vignette of the photograph gives the clue to the first step in making the drawing, which consists in sketching an elliptical shape, to which the outside forms roughly correspond. The second step will be to draw the leading stems, noting that the junction of the stems supporting the two left-hand stars

occurs at the centre of the mass. Though the curves are broken in the photograph, this is because of the exigencies of the stitching, such as seen on old-fashioned samplers, which requires that curves shall be represented by steps corresponding to the meshes of the fabric. The block is so small that many students are likely to miss this point, and mistake the steps for mere irregularity. But the steps should be ignored, and the curves drawn correctly.

Next, the forms should be set out. The flowers should be sketched in as circles or pentagons, and it might be noted that straight lines joining their centres would form practically an equilateral triangle.

The candidate is then asked (*a*) to make a drawing to show how far the ornamental form in the diagram has been inspired by a study and knowledge of nature. One supposes that the examiners want drawings of a plant of which the photograph is a decorative representation. But the design is so conventional that it seems not to be based on any particular plant. There are plenty of five-petalled flowers, but as a rule such have their outer edges rounded. The daffodils and narcissi have six petals. The leaves give no clue, and the students might easily have spent all their time in puzzling out this point.

Alternative to this question, the candidates are asked (*b*) how the knowledge of some similar decorative form may have provided a suggestion for the ornamental arrangement of the spray. The examiners perhaps expect the answer that the arrangement —which is only feebly decorative in itself, and not at all the transcendental design they appear to think it—is based on the scroll or wavy line, which has formed the basis of patterns ever since the Bronze Age, when the old metal-workers found they could make designs by bending wire round into spirals and scrolls, which were then affixed to their weapons.



Question 4.

Then the examiners ask for a drawing of an object to which the decorative form in the diagram might fitly be applied, the decoration to be shown in position.

This is a most extraordinary question, bearing in mind the students who were expected to answer it. Only a student of advanced design could be expected to do anything with it.

The last section of Question 1 is another poser, which one expects to see only in the art examination in principles of ornament. There are no beautiful features in the design, which in itself is a poor arrangement of spiky forms not very well executed. It was, no doubt, quite harmless in the general scheme of which it formed a part. The examiners probably mean the *abstract* beauty, which can be seen, if sought for, in the meanest pattern, such as *tangential curvature*, seen here in the springing of the flowers and buds from the stalks. *Radiation* is seen in the lines of the buds and flowers. Explanatory sketches are required of these principles, which at once removes the question into the domain of ornamental art. But the examiners *may* be thinking of something quite different.

In Question 2 the desks should be marked, facing towards the object like the spokes of a wheel. Care should be taken that the blackboard is well back, so that all the pupils may have a good view of it.

The second part of the question is again one likely to complete the demoralisation of the candidate. If the scholars are of *widely* varying attainments and ability, they should not all be set to draw a simple rectangular box. And how to secure that each individual of a class should receive the amount of instruction necessary to ensure due progress is a problem which ever baffles teachers, and about which a complete essay might be written. What gauges the progress of the class? Is it measured by the weakest or the average pupils? A whole crop of questions springs up. Of course every teacher solves the question in his or her own way. One would say that with twelve scholars and an hour's instruction every one would be likely to get sufficient attention.

The third part of the question is on the right lines. It was needless to ask for a number of sketches. The lines might have been numbered. How should one commence the box? How should any drawing be commenced? By making marks or lines which give the greatest dimension of the object, thus enabling the drawing to be placed from the first rightly on the paper. It may be assumed that the two outer upright edges of the box give the greatest dimension. These should be drawn first, placing the drawing and settling its size. Next comes the middle upright edge, then the four lines forming the top of the box, and lastly the two base lines. Of course some students may be seated parallel with the box, and these require special teaching.

With regard to the last section of Question 2, the rectangular box is, of course, the type of an infinity of objects, all of which have rectangular ends and sides. Books, houses, tables, chairs, etc., are examples. Certain crystalline forms are based on the rectangular prism. But, as a general rule, natural forms are based on spheres and cylinders.

Question 3 is good, and the number of alternatives makes up for its difficulty. If only the candidates could possibly have reached it, they might have shown the difference in treatment rendered necessary by the different stages of development of the pupils. Thus, taking the cow as the example, for a higher class the fact that the animal is a ruminant might have been emphasised, and sketches made showing the processes involved in "chewing the cud." For younger children the special characteristics of the cow might be enlarged upon—the structure of the horns and hoofs, and its long tongue, which enables it to tear off the grass more readily. Lower still, the general aspect of the cow might be contrasted with that of the horse, attention being directed to salient forms—the horns above the ears, the cloven hoofs, the long tail ending in a bunch of hair, and the level line of back and head.

The growth of plants would probably be a more popular subject. The special characteristics should be brought out in the sketches. The buttercup family has two sets of leaves—one sessile and protecting the buds, the other growing from the root and possessing stalks. The cup-like shape should be emphasised by sketching the flower as an undivided cup first, the flower leaves being marked in after. The fact that the flower has only one whorl of leaves should be noted. The elaborately divided leaf should be drawn, and its structure, as fitting its environment, explained. In the meadow, competing with grasses and other plants for the oxygen of the air, the divided leaves enable the plant to arrange them so that none are smothered, all being able to reach their supply of air food.

All the other plants have their own interesting characteristics, which should be illustrated clearly by sketches.

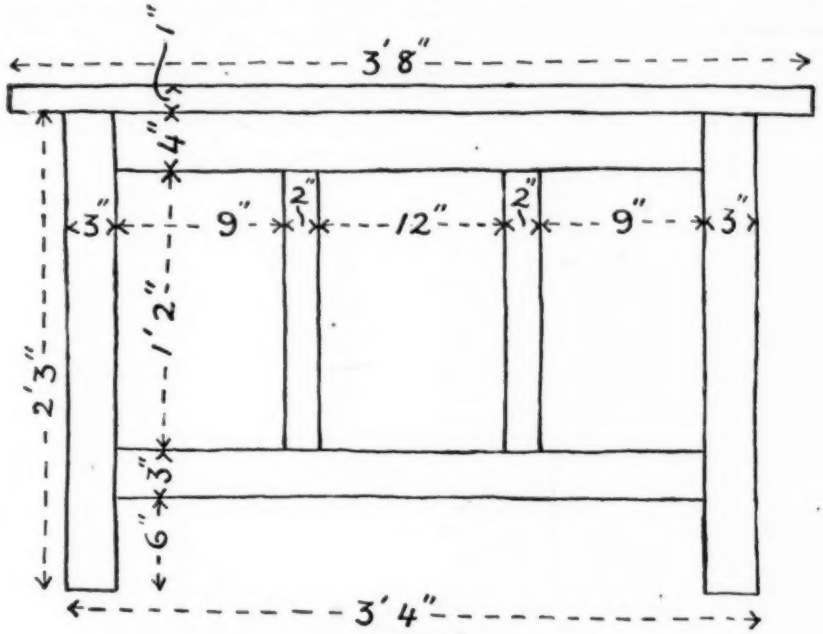
The question on modes of transit would be an opportunity to a student talented in drawing. It might be taken historically from the old stage-coach to the modern luxurious railway train, from the ancient coracle to the *Lusitania*.

Or, again, the *peculiarities* of transit are very interesting to children, and very good pictorial lessons could be given showing how climate and contour affect the varying modes of travelling in different countries. Sledges, carrioles, jinrikishas, camels, elephants, in other lands, take the place of horses, carriages, and electric cars in ours.

The subject is so interesting and fruitful of illustrations that it is likely to delude the student into wasting time upon it.

Question 4 administers a slap in the face to brush drawing as it is usually understood. Brush drawing is drawing done with the brush. If the pencil is used, it should be only to set out the technical planning of the design, or to sketch the *arrangement*

and the masses of the pattern, details being omitted. To bring this question within the limits of brush drawing, it should read, "Express or translate the coloured pattern with the brush. The details of form are *not* to be drawn with the pencil, which may be used, however, to set out the straight lines of the border and the main curve of the pattern." The student should then with the brush first lightly wash in the warm background colour. When this is dry, the bands of the border should be drawn. The three pointed forms of the central leaf should be made with three strokes without niggling the edges into the exact shape of the object. The comma-like forms above can be represented by direct strokes. For the serrated leaf a curved stroke should be made representing the middle part; and while the colour is wet, the serrations should be added with direct strokes of the brush.



QUESTION 5.

As the question stands, it could only be copied intelligently by a student of ornament. An examination of the original object from which the coloured photograph was taken would show it to be a piece of Oriental pottery painted with traditional forms, which *were outlined* with the brush. This outlining is to be deprecated in a school course of brushwork.

If the forms have been put down with sufficient depth of colour no outlining is necessary. The question betrays complete ignorance of what has come to be understood in the schools as brush drawing. Its effect will be to produce a reactionary movement in the art classes where the uncertificated teachers are trained, brushwork being reduced to a mere colouring of copies of fragments of ornament drawn with the pencil.

Question 5 is a straightforward question in scale drawing. As the scale is 1½" to 1', the rule marked with eighths of an inch will represent inches in the diagram, so that it will not be necessary to draw a scale. The measurements can be transferred from the rule.

Question 6 fairly takes away one's breath, remembering the total time allowed. Can such a course be described in general terms? The very term "describe" lures one into detail. The condition that the course is to include an infants' division is quite distracting, for in the infant school the drawing is, or should be, so woven up with the various forms of handwork and other lessons that it will be particularly difficult to fit it into the course of drawing if general terms only are to be used. The question exhibits in an aggravated form the faults of this paper, its lack of clear language, of knowledge of the requirements of the candidates, and of the aims and methods of drawing in the schools.

The syllabus was hailed as a new departure of good omen; this examination paper makes it impossible, by using its comprehensiveness as a rod of affliction for both students and art teachers.

Unless the Board of Education makes some pronouncement, the work of next year is likely to become demoralised by reason of another such examination paper looming in the future.

Meanwhile what of the students who during the past year have been working with patience and intelligence under art teachers who know their requirements? No matter how well prepared the student may have been relatively, such a paper reduces almost all to a dead level.

The examiners will probably award most marks to the more daring candidates who, after a scamper over Questions 1 and 2, found time to deal with the others. These students will have most to show, and will consequently receive the highest marking. But this is necessarily unfair to those who grappled conscientiously with the two compulsory questions, and found their time expired. It is quite possible that the best students hardly put pen to paper.

EDITORIAL NOTES.

The Certificate Examination Drawing.

MORE than a decade ago *The Practical Teacher* suggested that the candidates at the Certificate Examination should be tested in the theory as well as the practice of drawing. Knowing the educational aims and methods of a subject is as valuable as expert practical skill. Well, after rather more than ten years, the idea germinated, and a paper was set in December last. But what a set of questions! They fairly take one's breath away, and if the occasion was less serious one would be inclined to treat the whole thing as a joke. It is quite certain that no one could have set the paper who is familiar with the inside of an elementary school and who understands the aims and methods of work done there. Yet there are on the staff of the Board of Education men who do know, and know well, the whole educational aim of teaching drawing in primary schools. Probably, however, none of these were consulted when the questions were being compiled. Readers can judge for themselves of the absurdity of the paper by studying the article given above. We only hope that the candidates showed a better knowledge of the subject in answering the questions than the examiner did of the training and work of an ordinary teacher.

The International Congress is now within measurable distance. Chief among its attractions, especially for practical teachers, will be the international exhibition of drawings. An opportunity will be afforded of studying at first-hand the work of various countries, and of seeing something of the systems pursued and their results.

Already local exhibitions are being organised in Great Britain. Scotland, as usual in matters educational, leads the van. During the Christmas holidays a most complete exhibit of Scottish work was held in the Royal Academy Buildings, Edinburgh. It was opened by the Right Hon. John Sinclair, Secretary for Scotland, who in a most sympathetic speech combated the notion that the three R's were the be-all and end-all of education.

Two most important conferences were held during the Christmas vacation—The "Conference of L.C.C. Teachers and Educationists" in London, and the "North of England Education Conference" at Sheffield. At both meetings papers of great value to all interested in Drawing and other handwork were read. In London particular stress was laid upon the hiatus which at present exists between the manual work of the kindergarten and the workshop. It was shown that only very few authorities had taken steps to organise such work, London itself being woefully behind. To those in search of a beginning the article given below comes most timely.

CARDBOARD MODELLING FOR JUNIORS.

BY FELIX T. KINGSTON.

CARDBOARD modelling as a manual occupation is generally not begun until pupils have reached the Third Standard, age nine or ten years. The present series aims at providing for its introduction at an earlier period of the child's school life than is now usual, by outlining a few of the simplest exercises which are well within the capacity of younger children.

The drawing on which the course is based is that of Standard II., and no further drawing need be taught for the construction of the articles hereafter described; in fact, the models will provide a ready and necessary means of utilising, and showing the child the value of, the geometrical work which comprises the ordinary Standard II. syllabus.

An attempt has been made to simplify the work and to employ as few materials as possible. No curves have been included, and the typical geometrical solids have been omitted, giving place wholly to articles which will be appreciated by children.

Apparatus.—In addition to the ordinary drawing materials—ruler, set-square, etc.—each child will need a pair of scissors, costing about 5d. The earlier exercises will be done in brown paper, which should be of medium stiffness, similar to that used for packing heavy parcels; rather light in colour, so that pencil marks may be easily visible, to avoid eye-strain. One sheet, 45″ × 30″, costing 1d., will make the first twelve models—that is, allowing for no waste. In practice, of course, many models are spoiled, and must be remade; but the amount of extra material used in consequence of second or third attempts will depend on the skill and judgment of the teacher. The later models will be made out of thin card, which should be not thicker than a postcard, and of assorted colours. For fastening models, seccotine is the most suitable adhesive, as well as the cleanest and most economical to use. Le Page's liquid glue is also excellent. Gums and pastes are not strong enough, while ordinary cake glue is too difficult of manipulation by young children. As the work will in most cases be done at the ordinary school desks, some kind of pad will be necessary to place under the work. A piece of strawboard or millboard, about 11″ × 9″, and costing a farthing, will serve the purpose.

Where the teacher has little money to spend on manual occupations, it is better to use occasionally actual packing-paper, covers of exercise books (of suitable stiffness), or even the page from the drawing book itself, than omit handwork altogether.

The time allotted to the subject in order to carry out this course need not be more than forty minutes per week. The drawing of the model may, when possible, form part of the ordinary drawing lesson, thus leaving the handwork lesson free for cutting and fastening the models.

Model No. 1.—A Notebook.

First, the teacher will cut up a large sheet of brown paper as economically as possible—in this case into pieces about 6″ × 6″. On these pieces let the children draw an oblong 5″ × 4″, and bisect its area by the dotted line AB (Fig. 1). This, when folded in two, forms the covers. Next, each child will draw an oblong of same size on a piece of writing-paper to form two leaves of the book. As accurate drawing is indispensable, all faulty work must be condemned from the start, and the child's efforts repeated till the result is satisfactory. While waiting for backward ones, the forward children may make drawings for extra leaves for their models, for it is an advantage in earlier stages to secure uniform progress.

Before cutting out the models, some practice with the scissors will be necessary. The leaves of an exercise book will provide material, which the children may cut up into narrow strips along the blue lines. Insist upon making long cuts by opening the scissors wide every time, keeping the inside face of the scissors close up to the edge just cut, and stopping just before the points of the scissors meet. These precautions observed, it is possible to cut a line so even that the paper appears to have been severed with knife and straight-edge. Let the pupils run the fingers along the edges of the strips to detect possible notches and curves made by faulty cutting. Much good will result if a little similar practice in using the scissors precedes each of the next few lessons, as faults can be more easily prevented than cured.

Care should be taken to correct tendencies to stoop, and to hold the work too close to the eyes. At the outset, too, it is specially necessary to guard against littering the floor with scraps of paper, for it is just here that opportunities of being

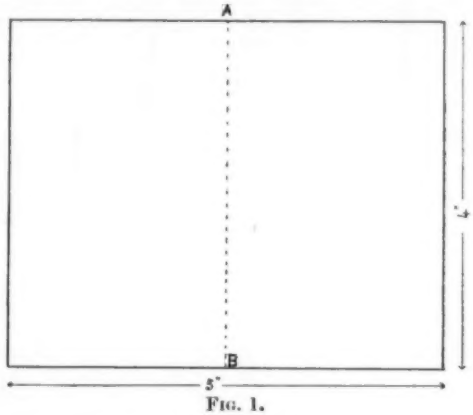


Fig. 1.

untidy may produce those bad habits which handwork, when well taught, should be the means of counteracting.

When the children have had, say, ten minutes' practice in cutting, they may turn to the model. Cut out carefully all the oblongs drawn. Let pupils superimpose them, and see whether they are of exactly the same size—namely, 5″ × 4″. Any faults previously undetected by an examination of the drawing will now become apparent.

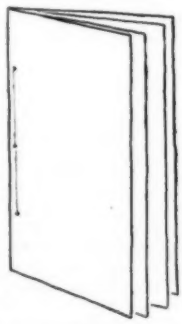


Fig. 2.

Before folding the pieces of paper the dotted line AB must be "scored"—that is, creased—so that the paper may fold evenly. Place one of the points of the scissors at B, and bring the edge of the ruler up to it; revolve the ruler until it is close to the line; remove scissors to the point A, and draw it lightly along the line from A to B, so as to indent the paper, but not to cut through or tear it. No damage will be done by the scissors to the edge of the ruler if the child presses lightly, and runs over the line several times instead of making a deep impression with one heavy stroke.

Fold the pieces of paper along AB, keeping the drawing *outside*. A further opportunity is now afforded the pupil of testing the work by observing whether both halves of the oblong are alike. Scoring must always precede folding, or else the child will see that the edges do not overlap, and allow the fold to take care of itself. It will be found that if the line AB does not exactly bisect the oblong, the error will be doubled when the paper is folded; hence the value of this subject in demanding accuracy and truth.

Models badly made should now be rejected, and the exercise repeated. Care must be taken that the child, before making a fresh start, sees *where* and *why* the model is faulty, thus bringing him directly into contact with cause and effect—a valuable training in reason and judgment which all constructive work affords.

As no two children will ever develop manual skill to the same degree, the wise teacher will differentiate among his pupils, and accept most work which he is satisfied is the *best* that the pupil can produce.

The leaves of the book may be fastened with needle and thread, or by means of a piece of thread tied along the back, just as the parts of a Christmas card are held together. And, by the way, this model may be called a Christmas card instead of a notebook, and decorated by the child with simple brush strokes to serve as such. All other models in this course are meant in the same way to be merely suggestive, to be adapted by the teacher to the circumstances of his case.

Model No. 2.—A Screen.

The pupils who have satisfactorily completed the first model may now proceed to make the screen.

This is based on an oblong 6″ × 4″, divided vertically into four equal parts, as shown in Fig. 3. The subdivision of the top line into twelve equal parts gives the child further practice in measuring half-inches.

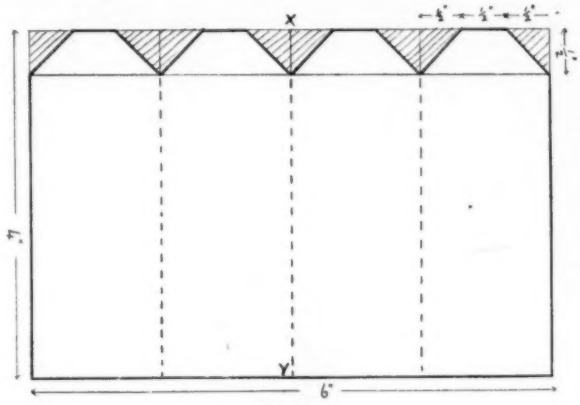


Fig. 3.

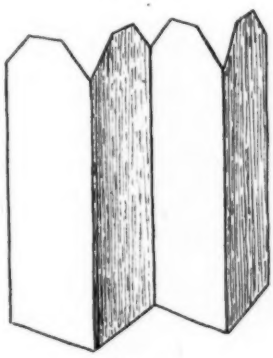


Fig. 4.

Having made the drawing on a piece of brown paper 8″ × 6″, cut out the whole oblong; score the dotted lines (note that the middle line XY must be scored on the *back* of the paper); cut away the shaded parts at the top of the figure; fold the screen, and test for errors by noticing whether the four panels, especially the sloping edges at top, fit exactly above one another. Some trouble would be saved by cutting off the corners after the screen has been folded; but much of the value of the exercise would thus be lost, for it would make no demand on accurate drawing of the top of the screen. Each model should be constructed in such a way that the maximum may be got out of it educationally.

The screen may be ornamented with brush strokes at some future drawing lesson.

Model No. 3.—A Boat.

The rectangle is again used as a basis, this time 6″ × 3″ (see Fig. 5). Take a piece of brown paper 8″ × 5″, and make the drawing as given; cut out the whole figure ABCD; score the lines EF, AG, DH; cut away the shaded (waste) parts of the triangles ABG and CDH, leaving strips about ¼″ wide, and taking care that the cuts from B and C extend right up to G and H respectively; the strips left are to be glued, to provide a means of fastening the model together.

The operation of gluing will need careful teaching. Take a newspaper and squeeze on it from the tube a pellet of seccotine about the size of a pea; this will suffice for a dozen models. With a strip of cardboard ¼″ wide, or a match stick, or any narrow bit of thin flat wood (a brush of any kind is useless), take up a little adhesive, and laying the model flat on the paper, with the drawing upwards, spread the glue evenly and thinly over one of the flaps left for the purpose. In half a minute it will have begun to dry, and will adhere more readily. Fold the paper so as to bring the edges CH, DH together, and fasten the flap on the inside of the boat. After ensuring that every part is securely stuck, the child will proceed to glue up the other end. Use as *little* glue as possible; where much is used it oozes out on pressing the flaps, gets on the fingers, and eventually bedaubs the model; or else it soaks into the flap, depriving the paper of its stiffness, and making adhesion impossible.

If preferred, the gluing of this model may be left until the

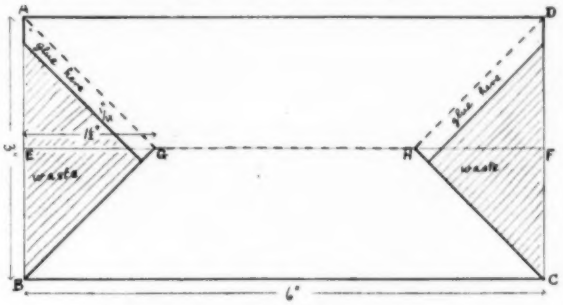


Fig. 5.

Fig. 6.

pupil has one or two others ready, when the whole might be fastened during one lesson. It will be noticed (Fig. 6) that the sides of the boat are curved, while stem and stern are slightly raised. Where correlation is desired, an imaginary voyage in this boat might form the subject of a story or an oral composition lesson.

Model No. 4.—A Bag.

Material, brown paper as before. Draw the oblong ABCD, 6″ × 4″, and complete as shown (Fig. 7). First cut out the whole figure, and then cut away the shaded parts; score the

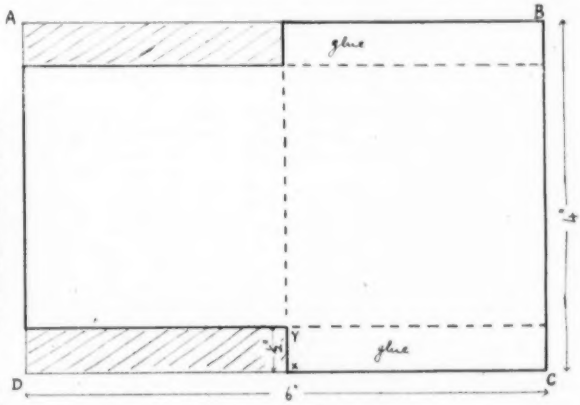


Fig. 7.

dotted lines; fold the model, and ensure that it is going to fit well. The edge XY may require a little more taken off it. When satisfactory, lay the model flat, glue the flaps, and fasten. When finished, the bag should be exactly 3″ square.

SOLUTIONS TO THE GEOMETRICAL DRAWING EXAMINATION PAPER.

APRIL 27, 1907.

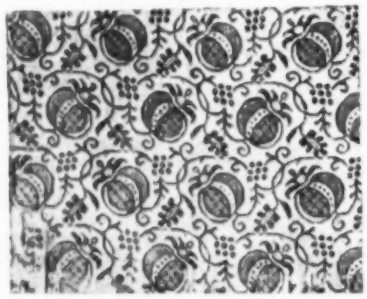
BY ROBERT J. PLENDERLEITH, ART MASTER, HARRIS ACADEMY, DUNDEE.

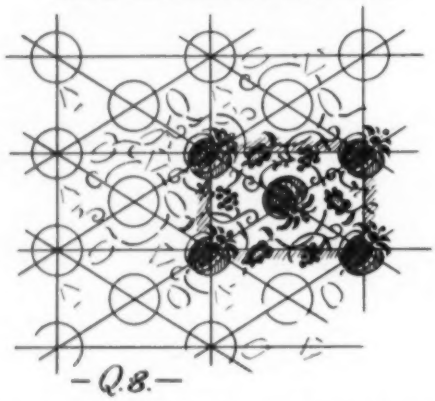
(N.B.—*Questions marked* [•] *have accompanying diagrams. The value attached to each question is shown in brackets after the question.*)

SECTION A.

Q. 1.—Make a *plain* scale, one-seventh of full size, by which feet, inches, and half-inches may be measured up to 3 feet. The scale must be properly finished and figured, and is not to be "fully divided"—that is, inches and half-inches are not to be shown throughout the whole 3 feet. Make a reduced drawing to this scale of the sheet of drawing paper on which you are working. [Twenty-two marks.]

Note.—Draw a horizontal line, mark the zero point, and set off one inch from O to the left. Divide the one-inch space into 7 equal parts, and continue the equal divisions up to 12. A rectangle, 22″ × 17″, is shown drawn to this scale.





—Q.8.—

Q. 2.•—Draw *half* the given figure, making the half-length 2¾″ and the height 1″. Show all your constructions, and all points of contact between circles. (*N.B.*—The diagram is not drawn to scale.) [Twenty marks.]

Note.—Construct the rectangle 2¾″ × 1″, and draw the medial line AB. The centre E of the arc CAD is found by bisecting AC to meet AB produced. The radii FC and GD are equal to EA. The centre of the small circle at K is found by setting out H at a distance from B equal to EA, and bisecting HG. Points of contact between circles are found by joining the centres.

Q. 3.•—Copy the given figure, making the radius of the outer circle 1·5″. The outer cinquefoil is to be formed of *semicircles*, the inner one of tangential arcs. [Eighteen marks.]

Note.—The cinquefoil division of the given circle is found by applying the usual construction for an inscribed pentagon. The centre E of the semicircle is found by setting off 45° at the point 5 to meet the diameter AB at C. The tangential arcs have the same centres, the radius being a distance perpendicular to AB drawn from E.

Q. 4.—About a circle of 1·3″ radius describe a quadrilateral ABCD having the following dimensions—

AB = 3″, BC = 3·2″.

The angle BCD is 82°.

Show all the constructions you employ, and determine the points of contact. Measure carefully and write down the remaining sides and angles of the figure. [Sixteen marks.]

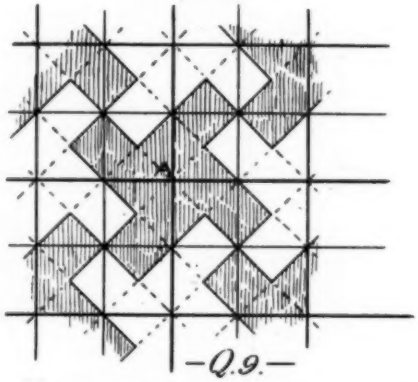
Note.—Draw a vertical radius EF, and also a tangent at F upon which to measure BC. GF is drawn at 82°, and through E a perpendicular HK finds K the point of contact of DC, which, being now drawn, determines the position of C. Measure off CB as given, and with B as centre rotate F to M, the point of contact of BA. The length of BA, as given, finds A, from which centre the contact point is again rotated to complete the figure.

Q. 5.—Find the shape of a sheet of paper such that when it is folded across the middle each half-sheet shall have the same shape as the whole sheet. Make the longest side 3″ long. [Eighteen marks.]

Note.—Draw AB 3″ long, and make $BD = \frac{AB}{2}$. Similar figures have their corresponding sides proportionate, and the solution in this case therefore depends on the construction employed to find the mean proportional between AB and BD. AB . BE is the sheet which, when it is folded at C, gives the similar figure BE . BC.

Q. 6.•—The diagram shows the side elevation of a shallow circular metal bath, resting on the ground and against a wall. Draw *either* the plan of the bath, *or* its elevation on a vertical plane parallel to the wall. [Twenty marks.]

Note.—The alternative solutions are shown at A and B. In each case the solution depends on the measurement of ordinates 1, 2, 3, and 4 along their respective projectors. The apex of the conical form is employed at *a a′* to determine the tangent sides of the bath on the plan A.



—Q.9.—

Q. 7.•—The roof plan of a building is given to a scale of 10′ to 1″. Draw its elevation upon a vertical plane parallel to the line *xy*, assuming that the height of the walls throughout is 10′, and that the slope of the roof throughout is at 45° to the horizontal. Only visible lines need be shown. [Eighteen marks.]

Note.—The heights H and *h* are obtained by setting off 45°, the given slope of the roof, on the plan, and transferring to the elevation on their respective projectors.

SECTION B.

Q. 8.•—Draw, with instruments, a system of construction lines on which the given repeating pattern can be set out. Then sketch in the main features of the design sufficiently to show the value of your construction. Mark very clearly what you consider the unit of repeat. [Eighteen marks.]

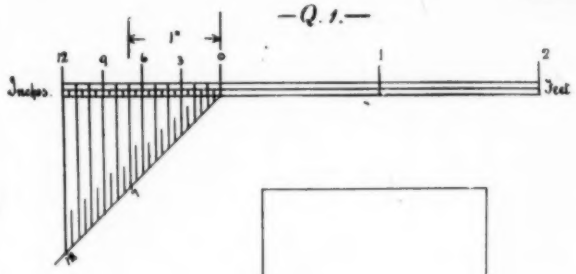
Note.—The design is planned on a rectangular system with diagonals. The circles serve as guides for the placing of the leading masses. One unit of repeat is shown.

Q. 9.•—The diagram is copied from an old Moorish tile. Set out accurately with instruments the pattern of which you suppose this tile was intended to form part; show at least four tiles. The dark portions should be indicated by slight shading. [Eighteen marks.]

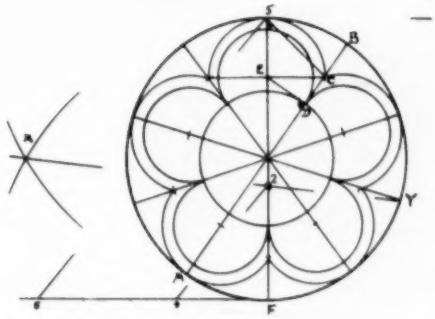
Geometrical Drawing

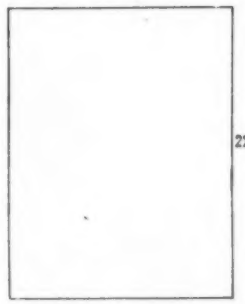
Section A

— Q. 1. —



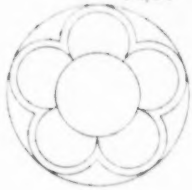
— Q. 3. —



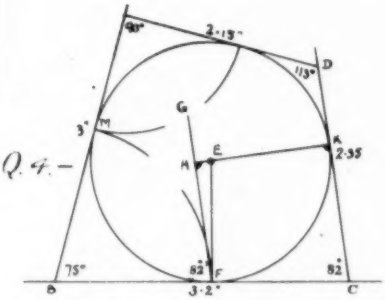


Q. 2. Diagram

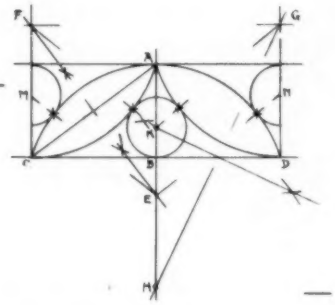
Q. 3. Diagram



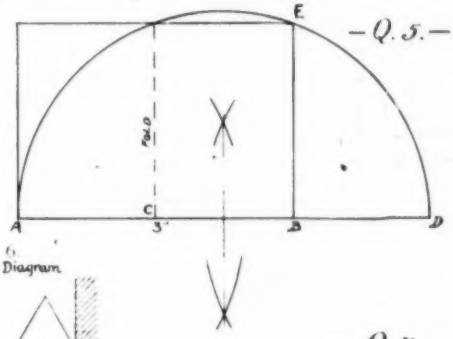
— Q. 4. —



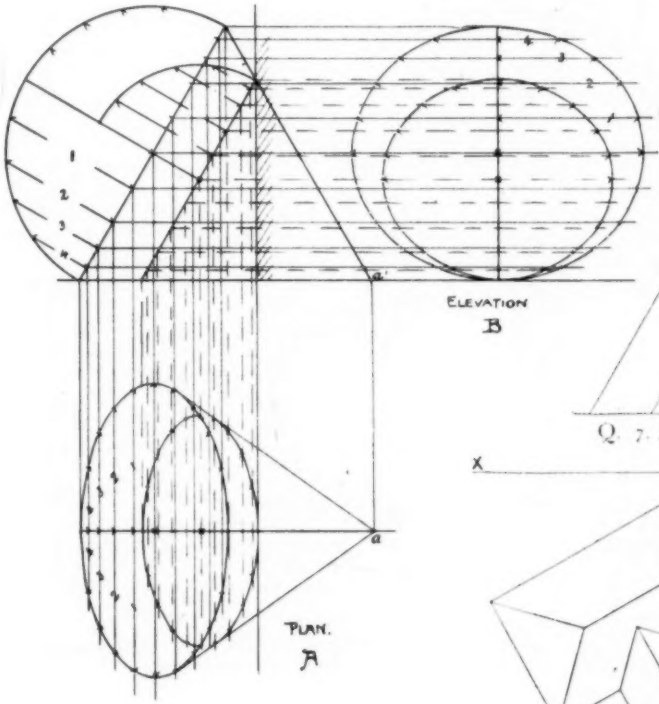
— Q. 2. —



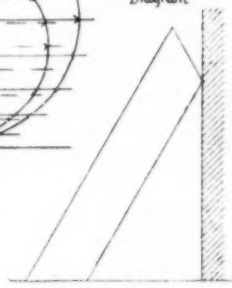
— Q. 5. —



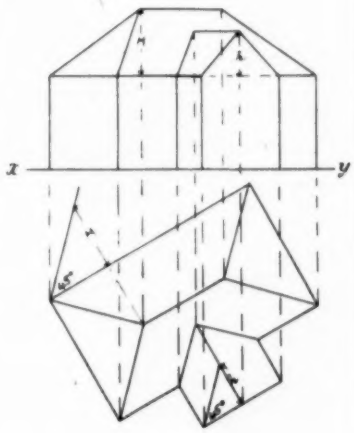
— Q. 6 —



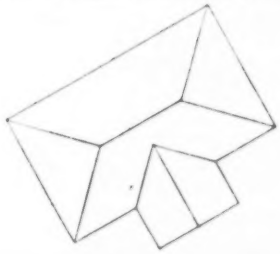
Q. 6. Diagram



— Q. 7. —

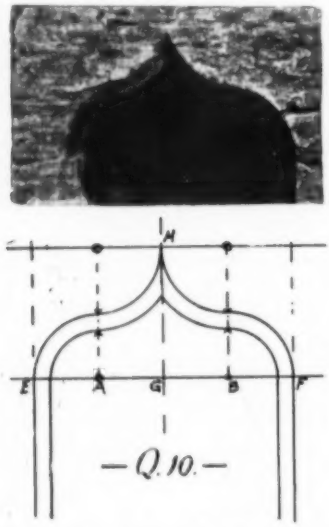


Q. 7. Diagram



Note.—Four tiles are shown arranged round the point A, each having the same angle turned to A, and the whole developing a regular series of symmetrical figures in counterchange.

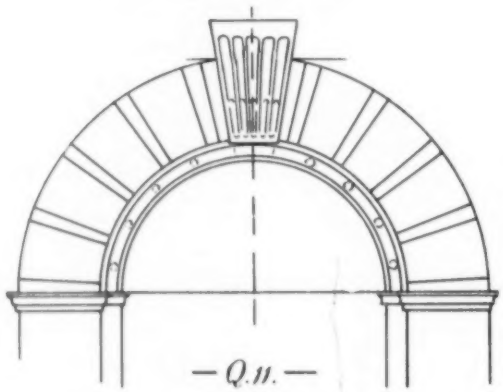
Q. 10.*—Make a careful approximate copy of the arch shown.



— Q. 10. —

Use arcs of circles for the curves, and show their points of contact. Make your drawing the same size as the diagram. [Eighteen marks.]

Note.—The figure shows an "ogee" door head, which is set out with four centres at A, B, C, and D. The width EF is divided into four equal parts, and verticals are drawn at A, G, and B, the height GH being equal to GE. The tangential points of the curves are on lines joining the centres.

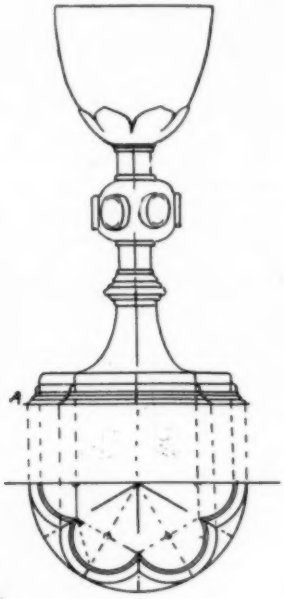


— Q. 11. —

Q. 11.*—Draw an approximately accurate elevation of the given semicircular arch, showing the arrangement of the voussoirs or arch-stones. Make your drawing about twice the size of the diagram. [Eighteen marks.]

Note.—The given figure does not give a true idea of height, being foreshortened vertically. The widths are taken across the lintel, and the arch being semicircular, the heights work out in the construction.

Q. 12.*—Make a sketch elevation showing the principal parts of the chalice, ignoring the smaller mouldings. Draw also the plan, or half-plan, of the foot of the chalice, showing your methods of setting out. [Twenty marks.]



— Q. 12. —

Note.—The form of the half-plan is arrived at by inscribing six equal arcs in a circle, the radius of which is taken from the elevation at A. The inner concentric arcs are semicircular.

INTERNATIONAL CONGRESS ON THE TEACHING OF DRAWING.

THE following list of names of authorities who should be invited to read papers at the Congress is recommended to the British Committee:—

1. Drawing in conjunction with Modelling and Manual work—Mr. T. P. Sykes.

2. The teaching of Drawing in the Professions, its definite inclusion in the University Curriculum—Mr. H. Hudson, as to the Army (five minutes); Sir William Richmond (ten minutes).

3. The training of Art Teachers—Referred to Training of Teachers' Sub-Committee for a Report.

4. The organisation of Professional Art Teaching—Mr. E. R. Taylor.

5. Schemes of Apprenticeship and Scholarship, Progress made since the last Congress—Professor Lethaby.

6. Unification of Signs and Symbols in Mechanical Drawing—To be dealt with on Sectional Day.

7. Methods of disseminating ideas in Art, and of developing public taste—Mr. Lionel Cust.

8. International Codification of terms used in the teaching of Drawing—To be dealt with on Sectional Day.

9. Experiments made towards establishing methods of teaching young children adapted to their nature and capacity—Mr. E. Cooke, Miss Kate Phillips.

C. M. MATHEWS, *Organising Secretary.*

Simple Brush Renderings of Flowers.

A NEW SCHEME OF HANDICRAFT.—VI.

ADAPTABLE TO THE REQUIREMENTS OF ALL TYPES OF SCHOOLS, BUT ESPECIALLY FOR PRIVATE SCHOLASTIC INSTITUTIONS AND SCHOOLS IN RURAL AREAS.

BY J. H. JUDD, SUPERINTENDENT OF MANUAL INSTRUCTION, MANCHESTER.

GROUP OF LESSONS.—XI.

THE general aim of this group is "neatness in execution in the several stages or sections, pencil-work, paper-work, woodwork."

In the drawing lesson it is definitely set out to secure neatness and accuracy in drawing parallel lines with or without mechanical aids—that is, parallel rules or set-squares—and in the placing in methodic order and sequence the necessary working dimensions. In commencing the lesson, a free drawing of the elevation of the "enclosure rails or garden railings"—Model 11 (Fig. 1)—is usually given on the blackboard. The children are encouraged from this to give a plan or top view or a side view in correct relationship one to the other, their efforts being guided by reference to a standard model. If necessary, these several drawings are corrected by the teacher, who then educes the names of the elements constituting the model. The common names of these may differ in localities, but it is essential that a definite name shall be given to each, in order to avoid confusion in future models involving similar details. In the drawing lesson—demonstration or unital—opportunities are offered for smart mental calculations of dimensions in giving over-all measurements between certain points, which include certain elements of fixed widths and spaces. A free transposing of the unit to standard measurement and *vice versâ* is desirable. Much interest is displayed by the children in making these calculations to ascertain the quantity of material, paper or wood, required for a completed model; the main object of the arithmetical innovation being to impress the necessity of measurements and dimensions placed in detail being accurately checked and made equal to the total or over-all dimensions, and to render concrete the abstract work of the ordinary lesson.

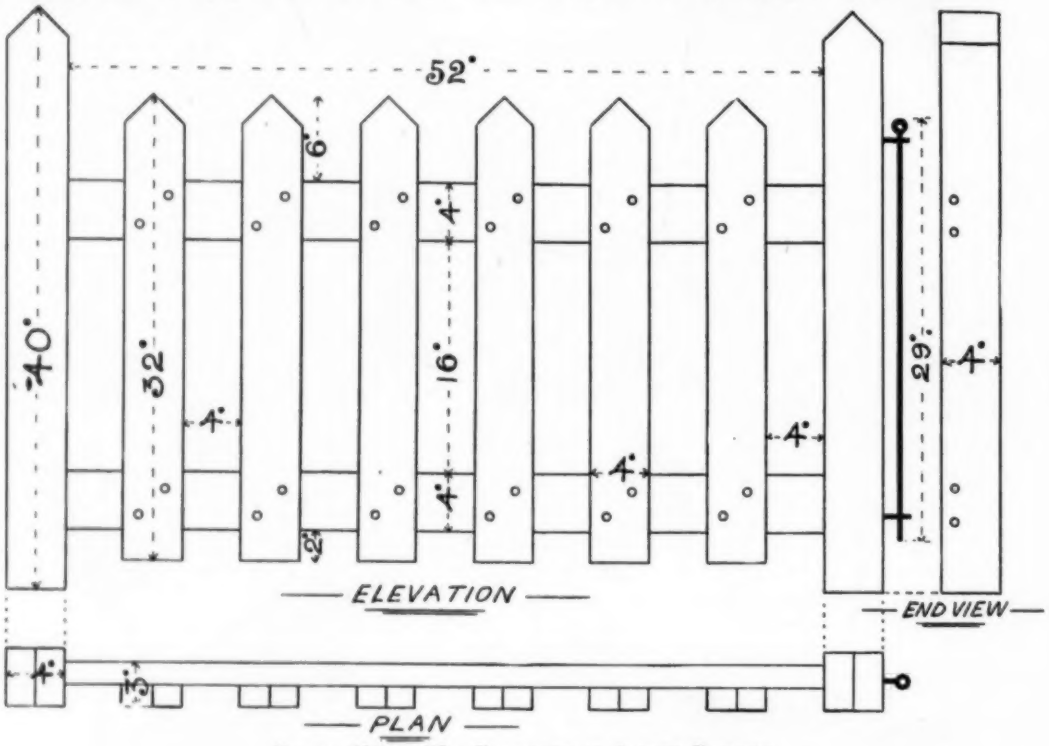


FIG. 1.—MODEL XI.: ENCLOSURE OR GARDEN RAILINGS.

The demonstration lesson thus completed, each unit in class is required to produce without further aid a full size line drawing consisting of front elevation and plan in detail, complete with detail, duplicate, and over-all dimensions in correct draughtsmanship style. The pointed heads of the rails are drawn with the aid of the 45° set-square and rule or T-square, as are also the nail spacing lines on each rail. A complete paper model (in two dimensions only) is made by the juniors as correlated paper-work, or for a gauge pattern with which to test the woodwork.

The quantity of wood required, and the particulars of the sizes of each element being calculated and checked by the teacher (or by another child in the class), are added by the side of the drawing for future guide and reference.

Before we proceed to the practical work we recapitulate or educe the procedure adopted in making previous models where simple overlay construction was the principal feature, as in Models 1, 2, 8, tabulating the results thus obtained in proper sequence on the blackboard under the heads of (*a*) "laying out;" (*b*) methodic procedure in preparing stuff; (*c*) construction; (*d*) testing. This becomes the class guide to attain the preconceived aim of the practical work lesson—that is, "to teach proportion in spacing (*a*) by sight, (*b*) measurement, simple overlay construction, and long nailing in narrow stuff."

The results obtained by this apparently self-instruction method has far exceeded all expectations, and we attribute the cause largely to the fact that children and teacher theoretically change places; the "make-believe," the very life and essence of childhood joys and pleasures, has for a time at least been usurped by the teacher.

A real teacher will make the children believe and fully realise that the work done on the blackboard for use as a class guide is entirely their own work, whereas the doing of it has been judiciously guided along certain definite and correct lines previously decided upon by himself. Kindergartenists will fully understand what is here inadequately expressed: it is in the doing, not in the translation to bald statements, that the effect is made clear.

In the practical work the method decided upon for forming the pointed head of each rail, and the tops of the side posts in either the drawing or paper-work lesson is followed, the saw being the tool used to remove the waste wood (the method and position for sawing at an angle is shown in Fig. 2), and the work proceeds methodically without apparent effort until the whole

model is completed. To give greater stability to the finished model, a short piece of strip-wood, say 12" long, is double-nailed

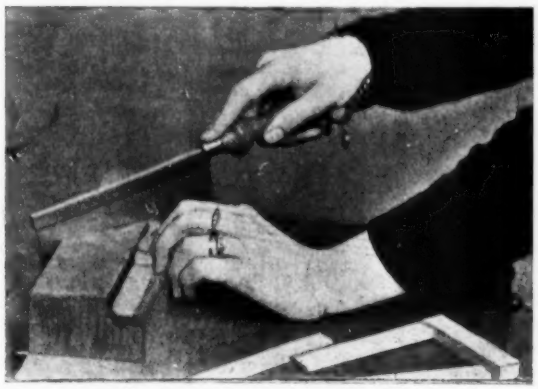


FIG. 2.—SAWING AT AN ANGLE.

on the bottom of each side post. This additional element often offers valuable evidence of inefficient cross-cut sawing, provides a ready way of administering a smart rebuff to the self-conscious and assertive scholars who "cannot possibly go wrong;" it also effectively shows winding instability caused by non-vertical sawing.

To make the model more complete, it is usual to fit two wire eyelets into one side post, and through these pass a long wire pin, with a loop at the head, to make the hinge connection between the rails and a swing gate. The demonstration lesson on the making of wire eyelets for use with Model 6—"the reversing spinning-mill"—is generally repeated here, each child in class afterwards making sufficient for the requirements of this and the succeeding model.

Figs. 3 and 3*a* show variations of joining of side posts and rails, which provide a means of combining the work of several members of a class in order to construct a full set of railings for enclosing a model playground, garden, or stockyard. A model of this kind was made last year in one of the Manchester special schools, and is now used as an object lesson on "playgrounds in our parks." It includes the following models, made by the children as alternatives—parallel bars, giant stride, scaling ladder, horizontal bars, vaulting-horse, four-place swing and rings. None of the children who worked on this group or commune model were above eleven years of age, or capable of doing old Standard III. work of the ordinary Code subjects.

The sequence lessons are given on enclosures, such as colonial compounds, stockades, penal settlements, or some other similar examples where railings are an essential feature of the whole. Alternative models suggested are simple overlay trellis, a bath-mat, or plate-draining grid.

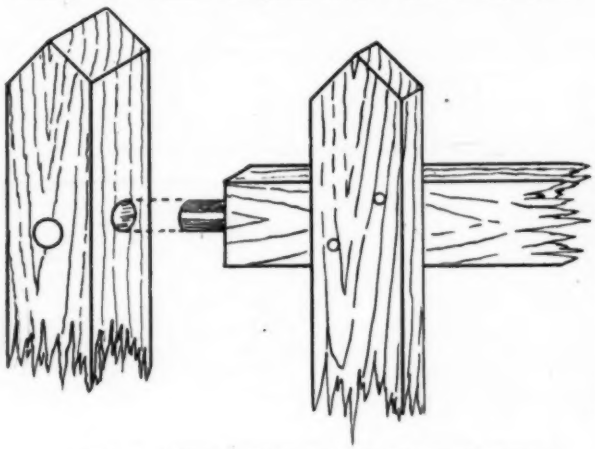


FIG. 3.—JOINING RAILS TO SIDE POST WITH DOWEL.

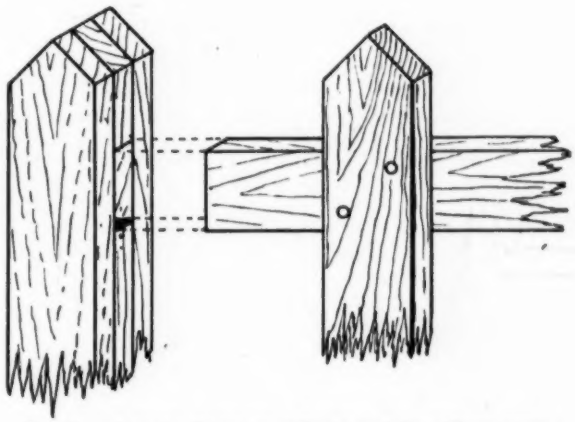


FIG. 3a.—JOINING RAILS TO "BUILT-UP" SIDE POST WITH MORTISE.

FOR some years past the Glasgow Corporation have voted a sum of money to be given as prizes for the best studies made by scholars in the various museums throughout the city. During the New Year holidays a selection of the best drawings were shown. The open ceremony took place on December 31.

There was a large attendance of ladies and gentlemen, including several representatives of the Corporation, as well as of the various School Boards. Bailie Shaw Maxwell (convener of the committee) presided, and introduced the Lord Provost. Before doing so, the chairman read the following report by the judges, and intimated the prize-list:—

"The works sent in this year give proof of careful discrimination having been shown in the selection of the material to be copied, and the result is a collection of studies that, in the majority of examples, are at once artistic and of sound educational value. The execution, especially the care and finish pertaining to the more advanced studies, marks a striking progress over anything that has been accomplished in previous years. These results have been made possible by the attention that has recently been given to the study of drawing in schools, and above all by the sound teaching that has been brought to bear upon the subject. Further, these studies are testimonials to the cultured influence that art is exercising over the juvenile minds and instincts, an æsthetic gain that should be of much future value. As showing the progress that has been made, the studies submitted this year in the third class—namely, between the ages of twelve and fourteen—would, when the competition was inaugurated some five years ago, have been accepted as the best results obtainable at that time. The number of works sent in are fewer than in previous years. This arises, it is believed, solely from the reason that the competitors from Primary Schools which have no art department or special teacher of the subject are unable to meet the high standard set by the pupils in Intermediate and Secondary Schools, and have therefore been compelled to relinquish their share in the competition. To obviate this state of matters, it is suggested by the judges that all schools be invited to compete, but that the contributions be divided into two classes—namely (*a*) those coming from the Primary Schools; and (*b*) those from the classes under special art teachers in Intermediate and Secondary Schools, and, further, that the prizes be allotted as separate awards to these divisions. By this means it is hoped that a still wider interest will be aroused and an equal opportunity afforded to pupils of all classes and grades.

"It is understood by the judges that pupils are aided by their teachers to make suitable selections of materials to copy, but beyond this no help whatever should be afforded, either in the treatment or the execution of the drawings. The competitors should be left entirely to themselves. It is also suggested that colour studies should be more frequently attempted, and scope thus given for the development of a very primary instinct in children—namely, a love of colour.

"JAMES GRIGOR, *Sub-Inspector, Scotch Education Department.*
"JOSEPH VAUGHAN, *Superintendent of Drawing, Glasgow School Board.*
"FRA. H. NEWBERY, *Director, Glasgow School of Art.*"

BOARD OF EXAMINATIONS FOR EDUCATIONAL HANDWORK.

(Recognised by the Board of Education.)

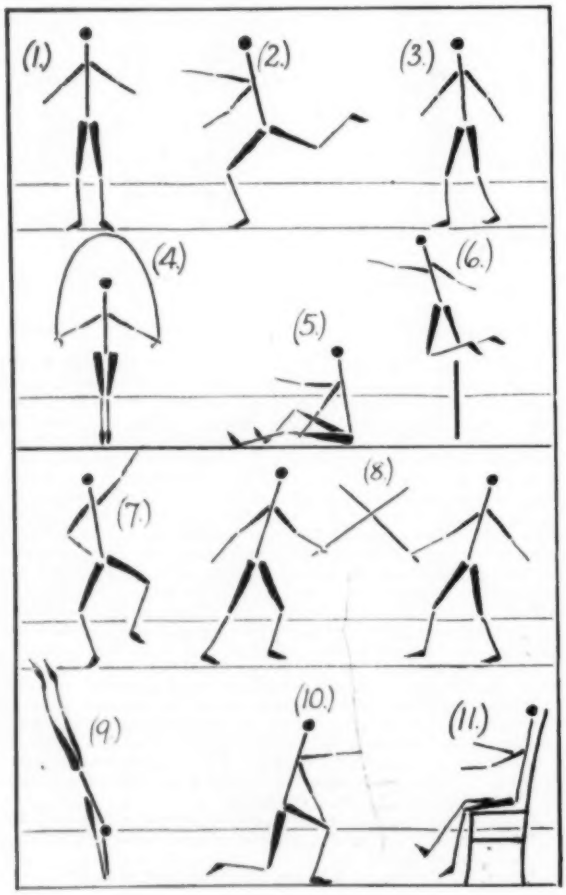
TABLE SHOWING RESULTS OF EXAMINATIONS AT SUMMER COURSES IN 1907.

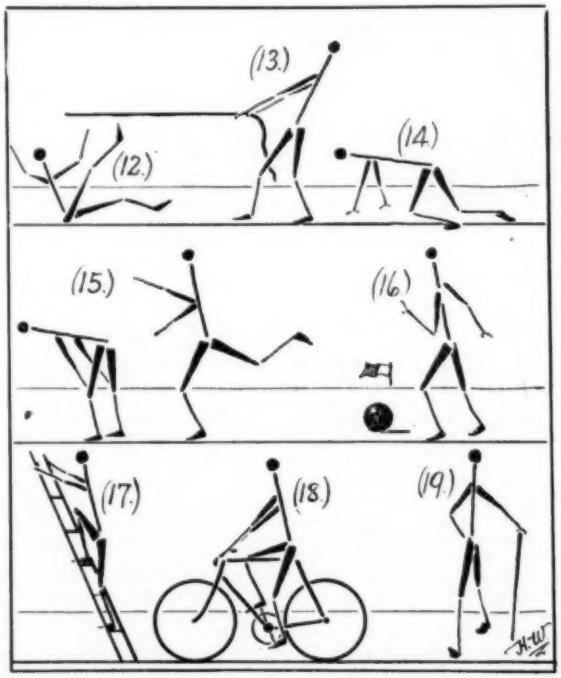
SUBJECT.	AMBLESIDE.						BARRY.						CARNARVON.						SCARBOROUGH.					
	Teacher's Certificate.			Teacher's Higher Cert.			Teacher's Certificate.			Teacher's Higher Cert.			Teacher's Certificate.			Teacher's Higher Cert.			Teacher's Certificate.			Teacher's Higher Cert.		
	Entered.	Certificates awarded.	Passed with distinction.	Entered.	Certificates awarded.	Passed with distinction.	Entered.	Certificates awarded.	Passed with distinction.	Entered.	Certificates awarded.	Passed with distinction.	Entered.	Certificates awarded.	Passed with distinction.	Entered.	Certificates awarded.	Passed with distinction.	Entered.	Certificates awarded.	Passed with distinction.	Entered.	Certificates awarded.	Passed with distinction.
Kindergarten Handwork	...	...	...	...	...	...	12	12	1	...	...	...	3	...	...	...	...	...	5	3	2	...	...	...
Clay Modelling	6	6	...	...	...	...	7	5	...	2	2	...	6	3	...	2	...	...	6	4	...	...	...	...
Brush Drawing	4	3	1	...	...	...	23	10	...	1	...	...	14	4	...	1	...	...	9	8	1	...	...	...
Blackboard Drawing	1	1	...	...	...	...	3	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cardboard Modelling	2	2	1	...	...	...	5	2	...	1	1	...	4	1	...	...	...	...	8	8	1	1	1	...
Woodwork	7	5	2	2	2	1	9	5	2	3	2	1	8	3	...	1	...	...	20	13	3	3	2	...
Wood Carving	7	6	1	...	...	...	7	4	...	...	...	...	...	...	...	...	...	...	5	4	...	2	2	...
Metal Work	...	...	...	...	...	...	4	3	...	...	...	...	...	...	...	...	...	...	12	9	1	2	2	1
Repoussé (Metal) Work	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	3	...	3	3	...
Totals	29	25	5	2	2	1	70	43	4	7	5	1	35	11	...	4	...	...	68	52	8	11	10	1

Note.—In the above table, "external" candidates, and those ineligible for examination, are not included.

RECREATIVE DRAWING FOR JUNIORS.

BY HENRY WILKINSON, CERTIFICATED ART MASTER, HEADMASTER OF ASKEW ROAD BOYS' SCHOOL, GATESHEAD.





POSTURES.

(1.) Standing.
(2.) Running.
(3.) Walking.
(4.) Skipping.
(5.) Sitting.
(6.) Jumping.
(7.) Dancing.
(8.) Fencing.
(9.) Diving.
(10.) Kneeling.
(11.) Sitting.
(12, 13.) Tug-of-war.
(14.) Rising.
(15.) Leap-frog.
(16.) Football.
(17.) Climbing.
(18.) Cycling.
(19.) Walking.

Papers for Teachers of Infants.

THE MUSEUM IN THE INFANTS' SCHOOL.

BY CLARA E. GRANT.

(*Continued from page 362.*)

QUITE a valuable asset to the Scripture teaching is a shelf containing objects, actual or modelled, mentioned in the Bible stories, such as Londoners were able to gather at the recent Palestine Exhibition, many of wh ch are on sale, we understand, at depots connected with missionary work. Thus in our own school we have models of the "inn," the peasant's house with its "little chamber on the wall," an Arab tent, the sheep-fold, Eastern plough, and the women grinding the corn, together with the camel, locust, etc. These materially help children to picture Eastern life. and to deepen their interest and knowledge. Other shelves illustrate objects collected on holidays. Thus the "Swiss" shelf will have its châlet, bear, goat, goat-bell, and so on.

Picture Post Cards and Christmas Cards in the Museum.

Pictures of the animals, etc., views of their native haunts, various native or special costumes, will all be useful; a picture of the "Monument" will fit in with the fire materials; the "Crystal Palace" will lend interest to the "Glass" shelf. Comic cards are always enjoyed (though they should be carefully chosen), whilst Christmas cards often represent things now, perhaps, obsolete or unfamiliar to the children—for example, the spinning-wheel (so often referred to in fairy tales), grandfather's clock, travelling coach, and so on. Quite a beautiful touch can be given to the shelf on "Wood" if a card can be found representing Him who

> "Wrought with Joseph
> With chisel, saw, and plane."

The Children's own Shelves.

Every school should devote at least a part of its museum to the "Children's Own Cupboard." In this will be placed things brought by children—never mind how heterogeneous, the pleasure to them will be the same—their clay models, both class work and "free." At the end of the year the collection would start again, any suitable models being preserved to enrich other shelves.

How about the Cupboards?

It may be very properly asked by our readers, "But how are we to get sufficient cupboards for such a varied collection?" No doubt this is quite a serious matter in many schools, and yet we venture to suggest that cupboards will often follow a good collection, whereas a good collection does not always follow a cupboard. It is more than likely that many educational authorities would willingly grant cupboards where they found signs that they would be well filled. In one school known to us the fact that there was a good collection of objects already there secured the offer of a handsome flat showcase, not wanted by its old owners; and this was promptly utilised to demonstrate a "model flat" and grounds, to the never-ending joy and interest of its new proprietors.

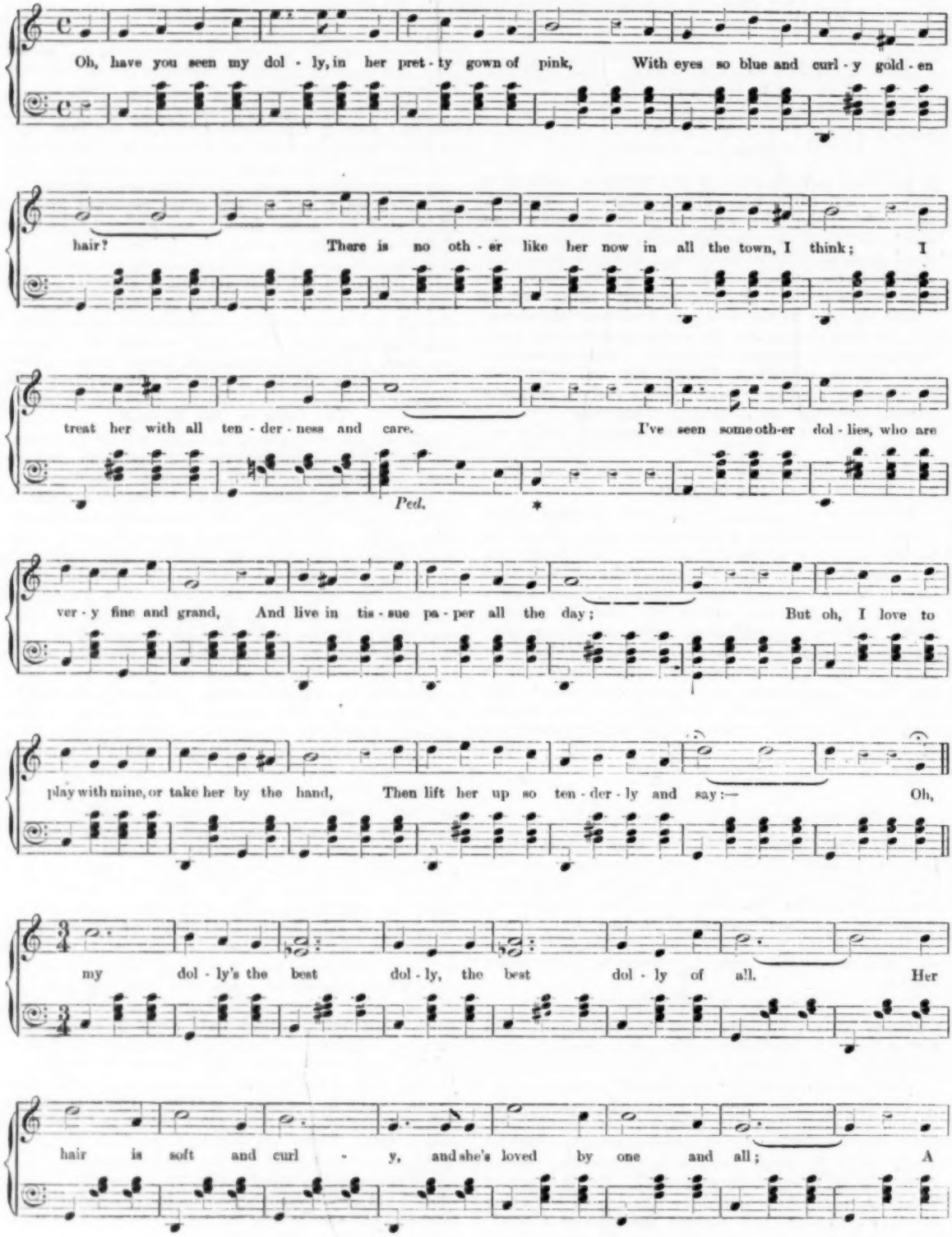
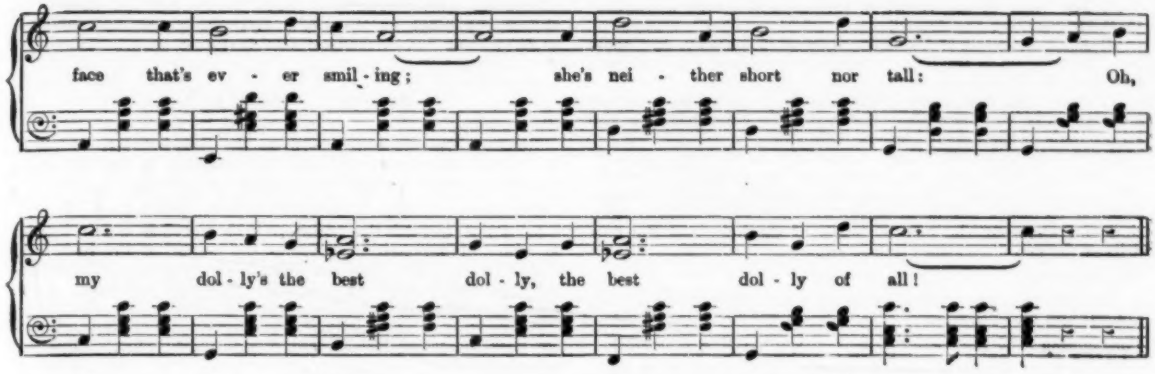
Cupboards need not necessarily be large or costly. The best kind is that which stands on the floor to a height of about four feet, with adjustable shelves, not too shallow. These do not occupy much space, and will often fit into recesses. The children are able to see all the contents, and the top of the cupboard forms a useful shelf for plants, flowers, and perhaps objects or models which will not fit into the shelves.

As for the cost of the collection, beyond the things voluntarily collected most authorities allow an annual sum for the purchase of suitable specimens, and probably all but the hopelessly parsimonious would gladly take this step where they could see that the museum was made a valuable educational factor in the school. It usually rests with the teachers to initiate these little reforms.

The Care of the Museum.

It is obvious that a good museum will need constant care and attention, frequent reclassification and readjustment, not forgetting the all-important "weeding out," so necessary if the collection is not to become a veritable embarrassment of riches. Too many objects, like too many books, tend to defeat their own aims; and, moreover, there is no room to grow—a most important point, since the moment a museum is looked upon as complete its best days are over. As a thoughtful American once said, "A finished museum is a dead museum." As the museum is for the use of all, and the work would be too much for one, the best plan is to ask the teachers to share the labour, each being responsible for certain shelves. Although it would be an education for older children to take charge of their museum under the supervision of the teachers, it is too much to expect that "infants" should manage this work, though they are only too delighted to "help teacher." Like all good things in a school, a good museum involves much loving labour, which, however, shared by all, could scarcely fall too heavily on any; and then, again, this particular work has a valuable reactive effect on those engaged in it. A museum is a standing embodiment of the good old maxim, "A place for everything, and everything in its place," which is as valuable in producing orderly minds as orderly cupboards. No good curator of a museum would, for example, pop down a Swiss châlet in the midst of an English farmyard, or a little puppy dog in the midst of "Some Things that we Eat." Then, again, most human beings have a joy in making collections, therefore why not woo that same joy from a hobby which will please and instruct thousands of others? The point is that wherever joy is obtainable no one minds the necessary trouble. There is all the difference between working for a hobby and labouring over a task. There are few lessons which cannot be enriched and enlivened by the school museum. The joy of the children alone makes it thoroughly "worth while." It may become a real source of interest to the teachers, and that is why we venture to plead its value in this little series of articles.

MY DOLLY.

Words and Music by W. R. FLINT.

Oh, have you seen my dol - ly, in her pret - ty gown of pink, With eyes so blue and curl - y gold - en
hair? There is no oth - er like her now in all the town, I think; I
treat her with all ten - der - ness and care. I've seen some oth-er dol - lies, who are
Ped.
ver - y fine and grand, And live in tis - sue pa - per all the day; But oh, I love to
play with mine, or take her by the hand, Then lift her up so ten - der - ly and say:— Oh,
my dol - ly's the best dol - ly, the best dol - ly of all. Her
hair is soft and curl - y, and she's loved by one and all; A

1. Oh, have you seen my dolly, in her pretty gown of pink,
With eyes so blue and curly golden hair?
There is no other like her now in all the town, I think;
I treat her with all tenderness and care.
I've seen some other dollies, who are very fine and grand,
And live in tissue paper all the day;
But oh, I love to play with mine, or take her by the hand,
Then lift her up so tenderly and say:—

Chorus.—Oh, my dolly's the best dolly, the best dolly of all.
Her hair is soft and curly, and she's loved by one and all;
A face that's ever smiling; she's neither short nor tall:
Oh, my dolly's the best dolly, the best dolly of all!

2. At times, of course, she gets a fall and hurts her pretty face,
And once she nearly lost her hair as well;
And then the sawdust started running all about the place,
One little arm was broken when she fell.
But while she keeps on smiling, and never, never cries,
I wish that I could nurse her all the day,
Or tell her all my secrets, for she looks so very wise.
I kiss her as I hold her up and say:—

Chorus.—Oh, my dolly's the best dolly, the best dolly of all.
Her hair is soft and curly, and she's loved by one and all;
A face that's ever smiling; she's neither short nor tall:
Oh, my dolly's the best dolly, the best dolly of all!

THE STORY OF THE RIVER.

A SCHEME OF CONNECTED LESSONS FOR STANDARD I.

BY E. MONA CLAY AND R. M. M. ATKINSON, INSPECTORS OF SCHOOLS, MANCHESTER EDUCATION COMMITTEE.

Eighth Month.

THE lessons for the two first weeks of this month deal with protective adaptations of plants and animals. Very many plants are conspicuous in showing most interesting modifications produced entirely for protective purposes. Sometimes harmless leaves are turned into weapons of defence, as in the nettle; whilst hair, spines, and thorns are developed frequently to perform duties of warfare. Similarly we may find animals arming themselves against their enemies, and in various ways adapting themselves to their surroundings and its demands.

The lesson on the "Earthworm" and that on "Springs" have, of course, a very special connection with the central idea. Teachers may be trusted to illustrate copiously on the blackboard when elucidating the origin of springs.

I.—SKETCH OF A LESSON ON HOW PLANTS PROTECT THEMSELVES.

Preparation.

Lead the class to see that all our lives we find it necessary to protect ourselves in different ways from the many and various things which we feel to be harmful to us. Question to see if the children can supply instances.

Presentation.

I. How plants may be injured.—Point out that plants often have to contend with many things which may injure them, or even threaten their very existence. Let the children, if possible, give examples.

(*a*) Refer to the raids of browsing animals on leaves and stems.

(*b*) The roots of many plants are attacked by such creatures as voles and mice.

(*c*) Give examples of flowers which have little pockets filled with sweet juice like honey, and tell of the insects which try to steal this juice.

(*d*) Certain plants which are weak in their stems, and others, like the daisy, which are small and insignificant, have to find means of ensuring that they will not be crowded out by taller and stronger plants.

II. The means of protection.—(*a*) Certain plants, such as the buttercup, the marsh-marigold, and the fern, are provided with bitter, and in some cases poisonous, juices, which cause them to be shunned by all browsing animals.

(*b*) Plants like the blackthorn, the gorse, and the holly are covered with thorns, spines, or prickles, as the case may be, which guard them very effectually from grazing animals. Can the children think of other examples?

(*c*) The sting of the nettle in like manner keeps marauders from approaching too near.

(*d*) Draw a sketch of the hairy stem of the poppy, and show how the position of the hairs prevents certain unwelcome insects from climbing up to the flower.

(*e*) Point out that some plants exude a sticky gum, which acts similarly to the above. Refer to the campions and the sticky buds of the horse-chestnut.

(*f*) Describe how the daisy ensures for itself room to grow by spreading out broad, flat leaves over the ground to prevent the growth of grasses, etc., near it. Mention also the devices adopted by other plants to safeguard themselves from extinction—for example, the twisting stem of the hop, and the tendrils of the pea plant, the vetches, etc.

Association.

Associate with the various methods taken by man to protect himself and his interests.

Formulation.

Plants have many devices to protect themselves from anything likely to prove injurious to them.

Application.

See occupations.

EXPLANATION OF ILLUSTRATIONS.

Teacher's illustration.—This illustration is merely suggestive, like many others. The teacher can, of course, select her own examples in addition to these. It would be best to draw these on the blackboard first, and then compare and contrast as the lesson proceeds.

TEACHER'S ILLUSTRATION.

Painting.—The nettle. This exercise should be used to emphasise especially the weapons of defence employed by the nettle. The colour will, of course, be green.

TEACHER'S ILLUSTRATION.

PAINTING.

Modelling.—No illustration is given for this. A good exercise for children would be to model a spray of gorse or a bare branch of blackthorn; either of these would be obtainable in country places, and either would bring out the special point of the lesson—the protective adaptations of plants. Another method of dealing with this subject would be to ask the children to choose any plant in connection with the lesson, and model it so as to bring out the one essential feature.

II.—SKETCH OF A LESSON ON HOW ANIMALS PROTECT THEMSELVES.

Preparation.

Refer to the previous lesson on the means taken by plants to defend themselves, and lead the children to see the many dangers to which animals of all kinds are exposed.

Presentation.

(*a*) Point out to the children that the fish which inhabit so many of our streams take on the colour of the rocks and stones about which they live. Lead the class to see the advantages of this. Refer also to the protective colouring of the snake and the grasshopper.

(*b*) Recall the lesson on the rabbit. Can the children remember how the white tail warned other rabbits when danger approached?

(*c*) The hedgehog is armed against its enemies by its sharp spines, while the stickleback's spine causes it to be generally avoided.

(*d*) The caddis grub protects its soft body by building a hard case (of whatever materials are at hand), out of which it rarely protrudes more than its head.

(*e*) Let the children enumerate cases in which the teeth of animals are used when necessary as a means of defence—the dog, the rat, the squirrel, etc. Refer also to the beaks of birds—the cock, goose, turkey, etc.

(*f*) Draw a sketch of the claws of a cat, and show how its weapons can be extended and withdrawn at will.

(*g*) Mention the change of colour which takes place during the winter in certain animals, such as the hare. Can the children tell the advantage of this?

(*a*) Allude to the very keen senses of smell, sight, and hearing by which many creatures are warned of the approach of danger, and let the class find out examples.

(*i*) The children will all know that certain animals have formidable means of defence in their horns. Refer to the cow, sheep, goat, and deer.

(*j*) Tell of the limpet, which may be found on the shore and in the estuaries of rivers, and explain its remarkable power of sticking to the rocks when molested.

(*k*) Mention how rooks guard themselves by always placing a sentinel to give the alarm if danger approaches.

(*l*) Describe how the bee, the wasp, and certain other insects defend themselves by means of a sting. Compare with the sting of the nettle.

Association.

Associate with the various ways in which plants defend themselves.

Formulation.

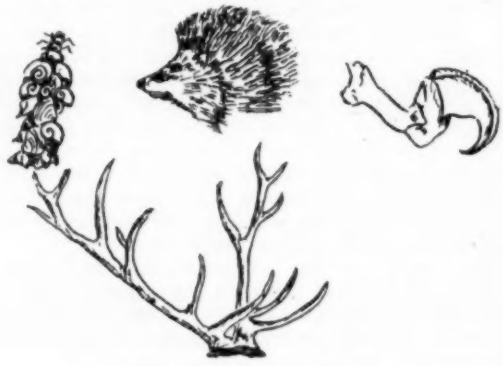
Animals, like plants, are provided with special means of defending themselves from what might prove in any way harmful to them.

Application.

See occupations.

EXPLANATION OF ILLUSTRATIONS.

Teacher's illustration.—Some common protective arrangements of animals are given here, to which, as in the case of the plants, many others may easily be added.



TEACHER'S ILLUSTRATION.

Painting.—This must be painted entirely in green, as it is intended to show the insect protected by means of colour. The insect should be painted first in outline, then filled in towards the head, with some white lines left to indicate the

PAINTING.

sections of the upper part. The grass behind may then be painted. Draw the strokes upwards; they will be easier to do. Put some lines—also green—for the ground on which the grasshopper rests.

MODELLING.

Modelling.—Directions for modelling a fish have already been given. This should be done in the same way, with the addition of the three spines by means of which the stickleback arms itself against enemies.

III.—SKETCH OF A LESSON ON THE EARTHWORM.

Required for Lesson.

Specimens of worm castings, or a model in clay showing their appearance; also a few earthworms.

Preparation.

Show castings, and let the children say what they are. Point out that they are composed of earth. Refer to the earth cast out by the mole, etc.

Presentation.

I. Description.—(*a*) *Shape.* Let the children examine an earthworm, and note that it is long and cylindrical in shape, that it tapers towards the head, and becomes broader towards the tail.

(*b*) *Body.* The body, which is without bones, is made up of a succession of ringlike segments joined by muscles.

(*c*) *Head.* At the end of the head is the mouth, which has a peculiar overhanging lobe. Let the children see how the tapering head is adapted for tunnelling. Contrast with the way the mole burrows.

(*d*) *Bristles.* Show an enlarged sketch of the worm, and point out that on each segment there are four pairs of bristles, which point backwards, and can be drawn into the body if necessary

II. Characteristics.—(*a*) Tell the children that the earthworm has no eyes or ears, but is very sensitive to touch. Refer to the undeveloped eyes of the mole. (*b*) The body is kept moist by a slimy secretion which exudes from the skin. This prevents the soil from sticking, and also makes the body slippery, an advantage when the worm is burrowing. (*c*) The worm's food consists of half-decayed plants and organic matter, which it gets out of the soil. Explain how the soil is swallowed, the nutritious substance kept, and the rest deposited as castings. (*d*) Let the children note how the worm moves about on the surface of the soil, and when burrowing. Show that this is done by the alternate contraction and stretching out of the muscles. Explain the use of the bristles, and how they take the place of legs. (*e*) Describe the worm's burrow, which is lined with earth, and blocked up at the entrance with decayed leaves or anything convenient.

III. The work of the earthworm.—The burrowing of earthworms loosens the soil and allows air and rain to enter. The soil also is altered in the worm's body, and is deposited on the surface in a fine powdery state, beneficial to plant life.

Association.

Associate the work done by earthworms with the turning over and loosening of the soil by the plough.

Formulation.

The earthworm, although a very lowly and unattractive creature, does a most important work in preparing the ground for the use of man.

Application.

See occupations.

EXPLANATION OF ILLUSTRATIONS.

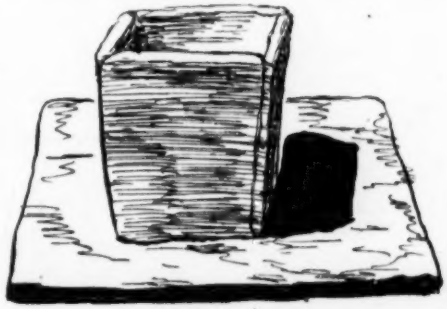
Teacher's illustration.—This shows the earthworm and a magnified drawing of the breathing apparatus. It would be best to draw this before the children as the lesson is being given.

TEACHER'S ILLUSTRATION.

Painting.—The colours required for this are green and brown. Paint the worms brown first. Outline them, and put very fine strokes along the bodies, as they will show up better in

PAINTING.

this way. Paint the grass behind green, and put some touches on the ground to make the worms stand out in relief. Of course, the value of an exercise of this sort is that it engages the mind and occupies it in dwelling upon impressions formed during a previous lesson, and thus deepens them.



MODELLING.

Modelling.—A slab is not absolutely necessary for this, but, as remarked before, it looks more finished if one be added. About a quarter-pound of clay for each child is needed; divide

it into five pieces. Make a flat square bottom by taking a piece of clay and pressing it out between the hands. It should be frequently laid down and pressed along the sides to keep them straight, and to see that the clay is kept of an even thickness. In much the same way form the four sides, only that in this case the pieces must be flattened out to an oblong shape instead of being kept square. When these are all fashioned weld them together, as shown in the illustration. A little moistening to the edges will be an advantage.

IV.—SKETCH OF A LESSON ON SPRINGS.

Required for Lesson.

A tin tray containing a layer of clay or slate, on the top of which rest layers of porous substances, such as soil, cinders, and sand. These should be built at such an angle as to allow water when poured on to find its way down the layer of clay.

Preparation.

Let the children imagine they are taking a walk along the banks of a river. Mention the little streamlets which are to be found all along the course. Many of these, if traced to the source, appear to trickle out of the hillside. Can the children account for the presence of water in such a place?

Presentation.

I. Porous and non-porous rocks.—Show by means of blotting-paper, a sponge, and a piece of clay or slate the difference between porous and non-porous substances. Lead the children to see that some rocks, such as chalk, beds of sand, gravel, etc., resemble the blotting-paper and sponge, in that they will allow water to soak into and trickle through them; while other rocks, such as clay and slate, in which the little grains composing them are packed very, very closely together, will not allow water to pass through them. Dip a piece of chalk and a slate pencil into ink, and let the class note what occurs in each case.

II. Underground water.—Refer to the lesson on the river, and recall that when rain falls some of the water makes its way down the sloping countryside as a stream, a certain amount evaporates, while the rest sinks into the ground. Explain very simply how this water trickles through such rocks as will allow it a passage and joins other water till an underground stream is formed. This eventually finds itself stopped by a layer of clay or slate, and as it cannot sink any further, flows along this rock till it finds an outlet on the surface of the land, and issues forth as a spring. Demonstrate this by means of the model.

III. The uses of springs.—(*a*) Springs provide a supply of water which can be collected by the formation of wells. (*b*) They replenish the various brooks and streams even in very dry weather. (Show what would happen if these latter were fed only after showers.) (*c*) Explain how water in its wanderings below ground takes up from the soil many substances, such as iron, lime, salt, etc., which are very beneficial to man. Springs also convey these substances from the earth to the various rivers and lakes, where they are used by the fish and other creatures dwelling therein.

Association.

Associate the history of underground water with that of the streams and rivers which flow along the surface of the land.

Formulation.

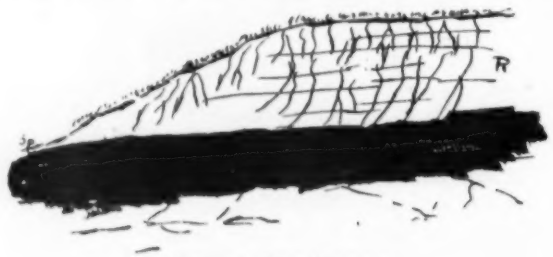
Springs are the outflow of water which has collected beneath the surface of the land.

Application.

See occupations.

Explanation of Illustrations.

Teacher's illustration.—This consists of a section of the land showing soil, rock, impervious layer, and the point where a spring issues. It can be made very helpful by using coloured chalks on the blackboard.

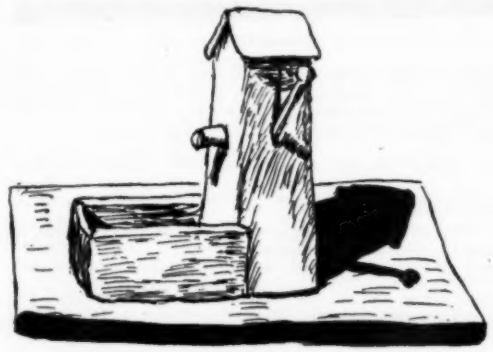


Teacher's Illustration.

Painting.—Probably the point of difficulty in this will be the drawing of the oval with the point of the brush, but it will be good to attempt it even if perfection is left far behind. The colours might be brown and faint blue, using brown for the fountain basin, the soil, and the trees, and very pale blue for the water issuing from the fountain and that in the basin. In the case of either colour avoid dense, hard colouring. It should be mixed very thin.

Painting.

Modelling.—There is a great deal of work in this model and a great deal of educational exercise. To model the pump, first roll a ball out of about three ounces of clay; from this obtain a cylinder by the method already described, and then again from the cylinder form a rectangular prism. This must be done by giving gentle taps to the clay on the modelling board as though for modelling the cube. Keep the two flat ends of the cylinder, and form the other four flat sides by the method given. It must, of course, be oblong in shape, not cubical. The rest of the model is easy to do, and the illustration explains itself. The top must be brought to a point, and a slab of clay made to cap it. The spout and handle will be easily added, and the trough is made in much the same way as the plant pot, the workmanship of which has already been described in this month's work.



Modelling.

NEXT MONTH.

The March number of the *Practical Teacher* will contain an interesting article on

DIRECT MORAL INSTRUCTION.

By Harold Johnson,

Secretary of the Moral Instruction League.

THE SCHOOL PLAY AS AN INTRODUCTION TO LITERATURE.

BY FLORENCE HOWARD ELLIS, WARLEY ROAD GIRLS' SCHOOL, HALIFAX.

THE FAMILY PARTY.

(Scene from "The Mill on the Floss.")

CHARACTERS.

Mr. Tulliver.	Uncle Glegg.
Mrs. Tulliver.	Aunt Glegg.
Maggie Tulliver.	Mr. Deane.
Tom Tulliver.	Mrs. Deane.
Kezia.	Lucy Deane.

Mr. Pullet.

Scene 1.

[*A sitting-room. Seated on chairs and sofa are* Mr. *and* Mrs. Tulliver, Mr. *and* Mrs. Deane, Aunt Glegg, *and* Cousin Lucy, *the last named looking very neat, pretty, and demure. Enter* Maggie, *very untidy, hair ruffled, and carrying hat swinging in her hand.*]

Maggie. O Lucy [*kissing her*], you'll stay with Tom and me, won't you? Oh, kiss her, Tom.

Tom. How do you do, Lucy? [*shaking hands, and holding himself at a distance*].

Aunt Glegg. Hey-day! Do little boys and girls come into a room without taking notice of their uncles and aunts? That wasn't the way when *I* was a little gell.

Mrs. Tulliver. Go and speak to your aunts and uncles, my dear [*looking at* Maggie's *untidy hair*].

Aunt Glegg. Well, and how do you do? [*shaking hands with* Maggie *and* Tom]. And I hope you're good children. Are you? [*kissing them loudly*]. Look up, Tom, look up. Put your hair behind your ears, Maggie, and keep your frock on your shoulder.

Aunt Deane. Well, my dears [*shaking hands*], you grow wonderfully fast. I doubt they'll outgrow their strength [*looking sadly at their mother*]. I think the gell has too much hair. I'd have it thinned and cut shorter, sister, if I was you: it isn't good for her health. It's that as makes her skin so brown, I shouldn't wonder.

Mr. Tulliver. No, no. The child's healthy enough; there's nothing ails her. There's red wheat as well as white, for that matter, and some like the dark grain best. But it 'ud be as well if Betty 'ud have the child's hair cut, so as it 'ud lie smooth.

[Maggie *is whispering to* Lucy.]

Aunt Deane. You wouldn't like to stay behind without mother, should you, Lucy? [*stroking* Lucy's *hair*].

Lucy. Yes, please, mother [*hanging her head*].

Mr. Deane. Well done, Lucy! Ler her stay, Mrs. Deane, let her stay.

Tom [*aside to* Maggie]. Go and get your hair brushed—do, for shame. I told you not to come in without getting it brushed first; you know I did.

[*Exit* Maggie.

[*Curtain down.*]

Scene 2.

[Tom *and* Maggie *in a room by themselves.* Maggie *takes a large pair of scissors from a drawer.*]

Tom. What are they for, Maggie?

Maggie. Look.

[Maggie *wears a wig, and cuts the front locks off.*]

Tom. Oh, my buttons, Maggie, you'll catch it! You'd better not cut any more off. [*Dances about.*]

Maggie [*goes on snipping*]. Here, Tom, cut it behind for me.

Tom. You'll catch it, you know [*shaking his finger and walking round her*].

Maggie. Never mind; make haste.

[Tom *takes the scissors, and cuts two heavy locks from the back.*]

Tom. O Maggie! [*jumping and slapping his knees*]. Oh, my buttons, what a queer thing you look! Look at yourself in the glass; you look like the fellow we throw our nut-shells to at school.

Maggie. Don't laugh at me, Tom [*stamping and giving him a push, and then beginning to cry*].

Tom. Now then, Spitfire! What did you cut it off for, then? I shall go down; I can smell the dinner.

[*Exit* Tom.

[Maggie *gets a brush and tries to straighten her hair; then she sits on the floor and cries.*]

Enter Kezia. Miss Maggie, you're to come down this minute. Lawks! what have you been a-doing? I never see such a fright.

Maggie. Don't, Kezia. Go away.

Kezia. But, I tell you, you're to come down, miss, this minute; your mother says so [*taking her by the hand to lift her up*].

Maggie. Get away, Kezia; I don't want any dinner. I shan't come.

Kezia. Oh, well, I can't stay. I've got to wait at dinner. [*Exit* Kezia.

Tom *enters.* Maggie, you little silly, why don't you come and have your dinner? There's lots of goodies, and mother says you're to come. What are you crying for, you little silly? [Tom *now tries to comfort her.*] Won't you come then, Maggie? Shall I bring you a bit of pudding when I've had mine? And a custard—and things?

Maggie. Ye—e—es [*looking brighter*].

Tom. Very well [*going away*]. But you'd better come, you know. There's the dessert—nuts and cowslip wine.

[Tom *takes her hand and gently draws her away.*]

[*Curtain down.*]

Scene 3.

[*A dinner table, around which all the relations are sitting.* Tom *and* Maggie *enter.* Mrs. Tulliver *drops the gravy spoon on the white cloth at sight of her daughter, and screams.*]

Uncle Glegg. Hey-day! What little gell's this? Why, I don't know her. Is it some little gell you've picked up in the road, Kezia?

Mr. Tulliver. Why, she's gone and cut her hair off [*whispering and laughing to* Mr. Deane].

Uncle Pullet. Why, miss, you've made yourself look very funny.

Aunt Glegg. Fie, for shame! Little gells as cut their own hair should be whipped and fed on bread and water, not come and sit down with their aunts and uncles.

Uncle Glegg. Ay, ay. She must be sent to jail, I think, and they'll cut the rest of her hair off there, and make it all even.

Uncle Pullet. She's more like a gipsy than ever. It's very bad luck, sister, as the gell should be so

brown—the boy's fair enough. I doubt it'll stand in her way i' life to be so brown.

Mrs. TULLIVER. She's a naughty child as'll break her mother's heart. [*Handkerchief to her eyes.*]

TOM. O my, Maggie! I told you you'd catch it.

[MAGGIE *sobs and runs to her father, hiding her face on his shoulder.*]

Mr. TULLIVER. Come, come, my wench, never mind. You was in the right to cut it off if it plagued you. Give over crying; father'll take your part. [*Takes* MAGGIE *on his knee.*]

Mrs. GLEGG [*aside*]. How your husband does spoil that child, Bessy! It'll be the ruin of her if you don't care. *My* father niver brought his children up so. We should a' been a differint sort o' family to what we are.

[Mrs. TULLIVER *looks resigned, and begins to dispense the pudding.* MAGGIE *takes her seat.*]

[*Curtain down.*]

N.U.T. NOTES.

BY ALLEN CROFT.

FOR a variety of causes, the Executive meeting due on the initial Saturday of the New Year was held on December 21, when considerable discussion ensued on the admirable memorandum issued by Sir Robert Morant on Medical Inspection of Children in Public Elementary Schools. The main feeling amongst the members was one of great satisfaction that at last there is a genuine prospect of the bodies as well as the minds of our little ones being adequately cared for. Criticism seemed to be centred on some three or four points:—1. The expense must necessarily be considerable, if effective action is to follow the inspection. The Executive ever view with apprehension any probable increase in the local rate levied for educational purposes, experience having shown over and over again that in many localities the cost of great educational reforms is largely borne by the teachers. My own decided view is, that if the Board of Education "mean business" in this matter, they will make arrangements for *the whole cost* to be borne by the Central Exchequer. 2. Several times in the memorandum a large augmentation in the work of the teachers is foreshadowed; but this, I think, will be cheerfully undertaken without expectation of fee or reward, so vast and important are the potentialities for both children and nation. 3. The possibility of friction betwixt the Medical Officer of Health and the "school doctor" appears to be somewhat serious, and in the opinion of the Executive the work should be undertaken by persons specially qualified to deal with young children. The final form of the Executive's motion was:—

Medical Inspection.

"The Executive regard the regulations contained in the recently-published memorandum respecting medical examination and treatment of children as a long-delayed recognition of the assertion repeatedly made by the N.U.T. and others engaged in educational work to the effect that it is impossible to produce the highest educational results from pupils whose physical well-being has been most imperfectly cared for.

"They therefore welcome the publication of these regulations as indicating the approach of a new era under which it will be possible to combine physical development with moral and intellectual progress.

"The Executive are, however, convinced that Medical Inspection must remain ineffective unless it be followed by suitable medical treatment.

"It is satisfactory, therefore, to notice that the memorandum recognises the importance of such medical treatment.

"The Executive desire to emphasise the importance of this new phase of educational work being entrusted to medical officers who are specially qualified to deal with young children, and who themselves should act under the direct guidance of the Medical Department of the Board of Education."

* * *

MY good friend Mr. C. W. Hole, to whom the 60,000 members of the N.U.T. are vastly indebted for his invaluable services as Vice-Chairman of the Executive's Education Committee, established a new record when he presented a petition from 1,429 women teachers to the President of the Union against what are commonly known as "combined departments." The full text of the memorial runs: "We, the undersigned women teachers, serving in Elementary Schools in England, do strongly protest against the growing tendency to combine departments under headmasters, and further petition the Executive of the National Union of Teachers to promptly take some steps to safeguard our positions, and protect us from the indignity of being compelled to serve as subordinates under a master. We contend that the training of girls and infants is especially a woman's work, and any scheme to deprive her of it is an insult and degradation to all women teachers and an unwarrantable depreciation of all the good work done by them in the past." The main feature of this communication has—during my thirteen years' tenure at Russell Square, at all events—continually had the active sympathy and support of the Executive; and scores of times during this period, whatever influence the Union has possessed with the Board of Education has been exerted to prevent such amalgamations of departments taking place. In my humble judgment, it is the system of allowing Gargantuan schools to be erected which is the foundation of the mischief, for these huge establishments are invariably *mixed schools, under a master.* When Sir John Gorst towards the close of his official career at Whitehall "found salvation" on this point and issued his famous building rules, and when the Board of Education less than two years ago caused to be written the famous Accrington letter, many of us rejoiced greatly, for it looked as if an era of common sense had begun. But we had reckoned without Mr. Reginald M'Kenna; for the present President of the Board apparently cares nothing for great educational principles, but devotes his undoubted force and energy to the mere politics of his high office. Why the 1,429 ladies who signed the memorial should feel so strongly *the indignity* "of being compelled to serve as subordinates under a master" I do not exactly comprehend. Possibly the words do not altogether mean what they say. Anyhow, the many estimable ladies of my acquaintance who at some period or other of their professional career have laboured as colleagues of a headmaster have given little or no indication of regarding such a state of affairs as "an indignity."

Against "Combined Departments."

MORAL INSTRUCTION THROUGH LITERATURE AND HISTORY.

BY "OBSERVER."

(*Continued from p. 345.*)

IN the first year of our course in incidental morality we confined ourselves for the most part to making an attempt to establish in the mind of the child some idea, however dim, of the difference between right and wrong, and creating a standard by which he might subconsciously measure his actions. In the second year this work ought to be extended and amplified, but a new element must also be introduced. The pupil must begin to learn what is wise or expedient under given circumstances apart from what is definitely allowed or forbidden. He must learn to know the fool and his folly, and to exercise his judgment in acquiring the knowledge. Literature of the right kind will help him to do this better than any other subject in the school curriculum. There is excellent morality in "Simple Simon."

The second literature reader in Messrs. Nelson's series mentioned last month * is entitled *Fairy Favours*, and contains fairy tales, folk tales, fairy poetry, folk-lore verse, and a few heroic legends of a simple character. Using this literary material, the teacher can readily work out incidentally the following syllabus in moral instruction for the class corresponding to the old Second Standard.

PART I.—LITERATURE.

1. The importance of keeping one's promise. "The Iron Stove."

2. The foolishness of losing one's temper. "Queen Mab and Oberon."

3. The grace of kindness—(*a*) To all our fellow-creatures, and especially to the poor and needy. "Fairies of the Caldon Low," "Mabel on Midsummer Day," "Tom Thumb," "In the Nursery." (*b*) To parents. "Shemus and the Little People," "Tom Thumb." (*c*) To animals. "The Herdsman," and the fairy poetry generally.

4. The necessity for the exercise of active virtues—(*a*) Wise reticence. "The Iron Stove." (*b*) Determination. "The Iron Stove." (*c*) Contentment. "Mr. Vinegar." (*d*) Self-respect. "Emperor's Dream."

5. The rewards of foolishness. "Three Foolish People," "Change About," "Mr. Vinegar."

6. Reverence for Nature. "Mabel on Midsummer Day."

7. The exercise of natural gifts—(*a*) Quick wit. "Tom Thumb," "The Iron Stove." (*b*) Resource and brave facing of difficulties. "The Herdsman."

PART II.—HISTORY.

There are many excellent historical reading books before the educational public, any one of which will serve as a companion to the above literary reader. But for convenience we will confine attention to the second volume of Messrs. Nelson and Sons' historical reading books, known as "Highroads of History." This book contains *Stories from British History* ranging from the time of King Arthur to that of Lord Roberts. The following are a few of the most important moral lessons which may be learnt incidentally from the reading of this book:—

1. Humility and loyal service. "Story of King Arthur and His Knights."

2. The civilising and refining influence of Christianity. "The Slave Boys at Rome."

N.B.—This influence can be treated as a historical fact apart from any proselytising or preaching on the part of the teacher. Neutrality must be carefully observed if the requirements of the "new morality" are to be met.

3. Moral courage. "The Story of Paulinus," "Oliver Cromwell."

4. Patriotism. "Hereward the Wake," and other lessons throughout the book.

5. Devotion to an exalted idea of duty. "God Wills It," "The Children's Crusade," "The Black Prince," "Prince Hal and the Judge," etc.

6. The warning of a bad example. "The New Forest," "The Story of Little Prince Arthur."

7. Consideration for the poor. "Turn again, Whittington."

8. Sympathy for misfortune bravely borne. "Bonnie Prince Charlie."

9. Perseverance in the face of discouragement. "An Idle Schoolboy," "How Canada was Won," "Jessie's Dream."

10. The wickedness of war waged for personal ends. "The Terror of Europe."

The teacher will see that it is a comparatively easy matter to draw up a syllabus of moral instruction from the literary and historical reading books used in each class. This can then be submitted for the approval of His Majesty's Inspector, and the moral instruction may then be imparted incidentally. It need not appear on the time-table as a separate subject.

* *The Royal Treasury of Story and Song.*

THE SCHOOL NATURE STUDY UNION.

WINTER PROGRAMME. PART II.

The following announcements will be of interest to our London and extra-metropolitan readers.

Friday, January 31st, at 7.45 p.m., at the College of Preceptors, Bloomsbury Square, W.C. (near British Museum Station, C.L. Railway).

"STUDIES IN SPIDER LIFE," by HENRY HILL, Esq.

Synopsis:—What is a spider? How spiders see, "talk," and hear. How they kill and eat their prey. Their feet and spinnerets. How a spider travels through the air, constructs a bridge across a stream, and makes her web. The life-history of spiders. How a spider lives under water and on water. Mimicry by spiders. Tunnel spiders and their wonderful underground homes. Detailed description of the English representative. Tragedy and comedy in spider courtship.

Chairman.—J. T. TAYLOR, Esq., I.S.O., L.C.C.

Saturday, February 29th, at 3 p.m.

ANNUAL CONFERENCE, to be held at ESSEX HALL, Essex Street, Strand (close to the Law Courts). Chairman—Sir GEORGE KEKEWICH, K.C.B., M.P. Further details will be given in the January issue of *School Nature Study*.

Wednesday, March 25th, at 7.45 p.m., at the College of Preceptors (please see above).

"THE OPEN-AIR SCHOOL" (illustrated by lantern slides), by Dr. F. ROSE. Chairman—T. S. DYMOND, Esq., H.M.I.

Further particulars may be obtained from the Hon. Secretaries—

MISS M. R. N. HOLMER, Bedford College, York Place, W.; and MR. H. E. TURNER, Bellenden Road, H.G. School, Peckham, S.E.

Our Students' Column.

HELP FOR CERTIFICATE STUDENTS.

English.

THERE seems to be a considerable amount of uncertainty as to what is required to be done in the section of "General Reading." The intention of the Board of Education is not that the works specified under this heading should be skimmed through in the superficial way in which novels are too frequently read, so that the reader may just say he has read it, and likes it or does not like it. Neither is it intended that such close attention should be paid to detail as is the case with books set for detailed study; but the reader should be able to show that he has derived benefit from reading the works set. We propose to deal with some of the books named—the student is not expected to have dealt with all—and indicate what should be done, and give what help seems necessary. The book we shall begin with is *The Cloister and the Hearth*, by Charles Reade. It is not expected that the student should prepare a biography of the writer; but as the knowledge of a few particulars serves to make the work more interesting, we may mention that Charles Reade was born in Oxfordshire in 1814, and died in 1884. The student who wishes for a detailed account of his life should consult *Charles Reade: A Memoir*, by his brother and his nephew, Mr. Compton Reade; or Mr. Swinburne's *Miscellanies*. The latter speaks in the highest terms of *The Cloister and the Hearth*, and says that it "would be difficult to find a story better conceived, better constructed, or better related;" and he considers its sympathy, pathos, and humour "qualities in which no other tale of adventure so stirring and incident so inexhaustible can pretend to a moment's comparison with it." These properties the book probably owes partly to the fact that Charles Reade desired most strongly to become a dramatist. Hence he thought out dramatic situations, and worked out the development of the plot and created the characters in the manner of one who is obliged to maintain the interest of an audience from the beginning of a play to the end. As a dramatist Charles Reade was not at all successful. In collaboration with Tom Taylor he wrote *Masks and Faces*, and received £150 for his work; but as the play did not succeed, he recast the substance of it into a novel called *Peg Woffington*, which had great popularity. Most of his novels belong to that class which had so much popularity about the middle of the last century—the novel with a reforming purpose. *It is Never Too Late to Mend* dealt with prison abuses in England and Australia; *Foul Play*, written with Dion Boucicault, is a daring romance of the misdeeds of the sea; and *Hard Cash* dealt with the management of lunatic asylums.

But the chief cause of the excellence of the novel is the deep research into the historical details surrounding the plot and the graphic way in which those details are worked up. The student who reads this book carefully, and tries to form a mental picture of the scenes and actions it describes, will acquire a very correct idea of life in the second half of the fifteenth century, and this was a stirring time in the history of Western civilisation. Such great movements as the Renaissance and Reformation were exercising men's minds, and many social problems were still awaiting attempts at solution. Among these were efficient police protection, and the treatment of criminals and paupers. Thus the careful reading of this book will not only afford interest and enjoyment, but will throw great light on the study of history by making the student realise the social and political conditions under which early historical events took place.

The conditions of time and place had their effects on the characters of the men and women living at that time, but yet they kept their own individuality, and Reade has delineated these characters in a charming way. The student would gain very little by having these set out for him; he must take notes as he goes along, and construct his own estimate of the characters from the words and actions recorded.

Next month I will give translations of the foreign words and phrases which occur in the story.

"Richard II."

The character of the king as delineated in Shakespeare's play corresponds very closely with that of the Richard the Second of history. As a boy he showed great courage in meeting Wat Tyler in 1381, and the spirit and sense which the young king displayed in this encounter with the insurgents gave promise of a glorious reign. But he soon negatived that promise; and as he advanced in years, the vices of his character began to display themselves—profligate extravagance, degrading subserviency to favourites, insolent impatience of prudent advice or lawful control, and a capacity for dissimulation and sudden vindictive violence which would have made him formidable, if he had not been deficient both in far-sighted judgment and in sustained energy of action.

Richard shows his inflated opinion of his kingly power at the end of Act I., Scene i., where, after an ineffectual attempt to make peace between Mowbray and Bolingbroke, he says:—

> "We were not born to sue, but to command;
> Which since we cannot do to make you friends,
> Be ready, as your lives shall answer it,
> At Coventry, upon Saint Lambert's day.
> There shall your swords and lances arbitrate
> The swelling difference of your settled hate."

Yet when the dukes meet at Coventry to fight the duel which the king himself has arranged, he not only forbids the fight, but sends them both into exile; and even here he shows weakness, for he is afraid to take upon himself the whole odium of the sentence, but speaks of it as

> "What *with our council* we have done,"

and he casts part of the blame on John of Gaunt himself,—

> "Thy son is banished upon good advice,
> Whereto thy tongue a party-verdict gave."

In the fourth scene of this act he shows his perfidy, and reveals his intention of not recalling his cousin (lines 20-36). In his next speech he shows his own personal courage, for his decision to take the field in person is one of the few bright spots in his career. He also admits his gross extravagance:—

> "We will ourself in person to this war:
> And—for our coffers, with too great a court
> And liberal largess, are grown somewhat light—
> We are inforced to farm our royal realm."

His heartlessness is shown by his remark on hearing of John of Gaunt's illness:—

> "Now put it, God, in the physician's mind
> To help him to his grave immediately.....
> Come, gentlemen, let's all go visit him:
> Pray God we may make haste, and come too late!"

Richard shows his insolent impatience of prudent advice when, in reply to York's entreaties that on the death of John of Gaunt he should not seize his property, he roughly says:—

> "Think what you will, we seize into our hands
> His plate, his goods, his money, and his lands."

When Richard returns from Ireland and finds that his kingdom has been invaded by Bolingbroke, he shows the weakness of his character by his sudden changes from highest assurance to deepest despondency. In Act III., Scene ii., lines 54–57, he declares his firm belief in his divine right:—

> "Not all the water in the rough rude sea
> Can wash the balm off from an anointed king;
> The breath of worldly men cannot depose
> The deputy elected by the Lord:
> For every man that Bolingbroke hath pressed
> To lift shrewd steel against our golden crown,
> God for his Richard hath in heavenly pay
> A glorious angel."

The speech in lines 144–177 show a depth of despondency which seems impossible in a man who has just expressed so much confidence in himself and in Heaven.

On meeting Northumberland, he greets him haughtily:—

> "We are amazed; and thus long have we stood
> To watch the fearful bending of thy knee."

But as Northumberland stands firm and shows no "fearful bending," Richard again climbs down and sends a welcome to Bolingbroke. But even in a crisis like this he cannot decide how to act, and appeals to his weak and treacherous cousin Aumerle for advice (121–132). On meeting Bolingbroke the

king shows himself lamentably weak, and seems to suggest that he is quite helpless, and that Henry should usurp his power.

> "What you will have, I'll give, and willing too;
> For do we must what force will have us do.
> Set on towards London, cousin, is it so?"

The deposition scene also shows Richard's foolish weakness.

When Richard has been deposed, and is in distress, we feel that he is intensely human in the way he bears his distress. He has not been taught to bear grief and pain with stoic fortitude, and few expressions can be more sad than the confession which comes at the end of a wasted life:—

> "I wasted time, and now doth time waste me."

The traditional manner of Richard's death is adopted by Shakespeare, and shows a last outburst of personal courage.

Elementary Science.

Short notes of lessons on substances of biological importance.

I. Air and Carbon Dioxide.

A. *Preparation.*—Call the attention of children to the presence of air in the room—to the fact that they breathe it, and that it is necessary to ventilate the room to prevent the air from becoming foul, especially if there are many people present and if the gas is burning. Point out the healthiness of outdoor occupations as compared with indoor ones.

B (1). *Presentation.*—Take two narrow, tall gas-jars; shake some lime-water up in one, and show that no appreciable change takes place. Lower a lighted taper into the other, and notice that it will soon go out. Shake some lime-water in the jar, and show that something has been formed by the burning of the taper which turns the lime-water chalky, and which led to the extinction of the taper. This is carbon dioxide, or carbonic acid gas. Explain that when a body burns in air the materials of which it is composed combine with the oxygen in the air; if the body contains carbon, one of the products will be carbon dioxide.

Take a flask fitted with a cork and two tubes, one of which goes to the bottom of the flask, while the other just goes through the cork. Half fill the flask with lime-water, and *draw* air through the shorter tube. The air of the room passes down the long tube and bubbles through the lime-water, and makes no appreciable difference. Next blow gently down the long tube, and soon it will be seen that the air coming from the lungs turns the lime-water milky, and therefore must contain large quantities of carbon dioxide. Point out that a change goes on in living bodies which is similar to combustion, inasmuch as the material of the body is oxidised; but although heat is produced, the temperature of the body does not rise nearly high enough to produce light.

C (1). *Association.*—Remind children of the Black Hole of Calcutta, and of cases of suffocation in mines and in lime-kilns, and other places where carbon dioxide is produced.

B (2). *Presentation.*—Since carbon dioxide is given off in such large quantities, it is evident that in course of time the whole air would become so charged with it that it would not support life or combustion unless some process were at work to restore the balance. Take a small quantity of watercress or other green-leaved plant and place it in an inverted jar full of water (which may have been charged with carbon dioxide previously), and set the jar in a window. Bubbles of gas will be found to be liberated and will rise to the top, and on collecting and examining the gas thus given off it will be found to be oxygen. This proves that green plants under the action of sunlight have the power to absorb carbon dioxide and give off oxygen. It must be carefully noted that it is only the green parts of plants that can do this, and then only in sunlight. The green substance which causes this change is called *chlorophyll;* it is not found in such plants as mushrooms and toadstools. These plants, and even green plants out of the light, use up oxygen and give off carbonic acid gas, just as animals do, though at a much slower rate. Hence plants do not purify the air in a bedroom, but rather make it worse at night.

C (2). *Association.*—Show the relation between the action of animals and that of plants on the air; point out the importance of parks and open spaces in large towns, such as London, and show how the green fields of the country help to get rid of the carbon dioxide produced by the towns.

D. *Formulation.*—When a body containing carbon burns carbon dioxide is produced. The same substance is produced by the vital processes in animals and plants. Carbon dioxide is used up by green plants in the sunlight and oxygen is set free.

E. *Application.*—The experiments performed by the teacher should be repeated by the scholars, who should be encouraged to see to matters of ventilation in their homes.

II. Ammonia.

A. *Preparation.*—Call attention to the odour of "smelling salts," or of so-called "ammonia," used to soften water for washing, and ask whether the children have ever smelt the same odour elsewhere.

B. *Presentation.*—Most of the substances that affect the sense of smell are gases, though these gases may be given off by solids or liquids. Ammonia itself is a gas, readily given off by many of its compounds, which are often spoken of commercially as ammonia. The odour is also to be noticed in unclean urinals and other places where animal matter is decaying. It is a compound of nitrogen and hydrogen. Hence if it is given off during the decomposition of any substance, it is a clear proof that the body contained nitrogen. It was first prepared from decaying camel dung near the temple of Jupiter Ammon, and from this fact it takes its name. It is now obtained as a by-product of the gasworks. Coal contains a small quantity of nitrogen and hydrogen, and when it is heated these come off united in the form of ammonia. We saw last month that animals take in highly complex substances as their food, and break them up into simpler ones. Most of the carbon leaves the body in the form of carbon dioxide, and we might expect that the nitrogen would be given off in the form of ammonia; but as a matter of fact, very little is given off in quite such a reduced state as this. In the human body most of it is excreted by the kidneys in the form of urea, a body which afterwards unites with oxygen and hydrogen, and forms carbon dioxide and ammonia. If a compound of ammonia or an organic body containing nitrogen is heated with quicklime, ammonia is given off. Heat a little ammonium chloride (sal ammoniac) with lime in a test-tube. Heat also a little nitrogenous matter, such as cheese, with lime in a test-tube. In both cases the smell of ammonia will be detected.

C. *Association.*—Compare the evolution of carbon dioxide by living bodies with the elimination of their nitrogenous waste.

D. *Formulation.*—Ammonia is a gas composed of nitrogen and hydrogen. It is given off by decaying organic matter which contains nitrogen.

E. *Application.*—The pupils should repeat the experiments worked by the teacher, and write the substance of the lesson as a composition exercise.

PREPARATION FOR JUNIOR PUBLIC EXAMINATIONS.

CAUSE AND EFFECT IN HISTORY.

The Glorious Revolution of 1689.

THE results of the great Civil War were, as we have seen, incommensurate with the loss of life and property which it had entailed. The Puritan section, by going to extremes, had alienated the sympathy of most of the nation, with the result that in the exuberant joy of getting rid of their yoke, the Stuarts were welcomed back without any definite settlement of points at issue, the Declaration of Breda not touching on the vital questions which caused the Civil War. Both sides seemed to be willing to pass them over—the Crown thinking that the opposition to its illegal measures had been exhausted; the people hoping that the exile would be a sufficient lesson to the law-breaking Stuarts. The definite settlement was postponed—but not for long. Forty years after Charles the First died on the scaffold his son was an exile.

Charles the Second, notwithstanding his promises to the contrary, broke the laws as complacently as his father had done. He issued declarations which superseded the laws, removed those judges from the Bench who retained their integrity and would not administer laws unjustly, levied excessive fines, and endeavoured by proclamations to carry out the principles of Divine Right. The Puritans were rendered powerless by the unjust Clarendon Code which was directed against them, and the only piece of useful legislation carried out was the Habeas Corpus Act, which effectively prevented improper and illegal detention in prison. Wiser than his father, he worked through ministers appointed by himself, whom he did not hesitate to sacrifice when Parliament became indignant. Thus Clarendon, the Cabal, Danby, etc., were in turn offered up to popular clamour for doing things which they had been instructed to do by the king.

But Charles was of an easy-going, pleasure-loving disposition, and was, from his courteous manner, a favourite with nearly all classes, who tolerated his illegalities as mere eccentricities, and contented themselves with protesting against the more serious breaches of the constitutional law.

His brother James, who succeeded him, was a man of different stamp. A staunch Catholic, he made every endeavour during his short reign to restore Catholicism, and succeeded in a very short time in arousing against himself a deep and bitter feeling. As we have before mentioned, interference with a man's religion always provokes the most strenuous opposition; and James, even to the end, did not seem to recognize the utter impossibility of making England a Catholic country. In his efforts he alienated the sympathy of every class in the nation to such an extent that he was unable to make any fight when matters came to a crisis.

Now, what were the causes which produced the Revolution? Although he declared to the Council that he was determined to govern constitutionally in Church and State, he immediately commenced to do the opposite.

1. One of his first acts was to demand by proclamation the continuance of those payments which had been made to his brother for life only. To these he had absolutely no right till the Parliament had met and voted supplies.

2. He issued another proclamation, setting free all those who were in prison for refusing to take the oaths of supremacy and allegiance. Although this was a measure of relief to the Puritans who were suffering under the Clarendon Code—and, indeed, James protested it was for their benefit—every one clearly recognised that it was primarily to aid the Catholics.

3. Against the provisions of the Test Act he allowed Roman Catholic officers to serve in the army, and, indeed, gave commissions to some.

4. He set up an Ecclesiastical Commission Court, resembling in its powers and functions the High Commission Court which had been so unpopular, and which had been abolished by the Long Parliament.

5. He claimed and exercised the dispensing power—the power to dispense with laws as he thought fit. He based his claim on the authority of the opinion of the judges; but he had previously ascertained their views, and where they were opposed to him, had deprived them of their seats, and replaced them by men who would support him.

6. He attacked the universities. He ordered the authorities at Cambridge to confer a degree upon a monk named Francis, and on their refusal deprived the vice-chancellor of his position. He next ordered the Fellows of Magdalen, Oxford, to elect as their president a Catholic named Farmer of notoriously evil life. On their refusal he nominated Parker, a Jesuit, and because he was not appointed ejected the Fellows from the college.

7. He endeavoured to maintain a standing army to overawe the city of London.

8. The conduct of the infamous Jeffreys and Kirke in their brutal Bloody Assize alienated the respect of the whole of the West.

9. He issued the Declaration of Indulgence, which gave complete liberty of worship to Roman Catholics and all Dissenters. The latter refused to accept it on account of the illegality.

10. He interfered with the elections, endeavouring to pack the corporations of the various towns in such a way as to be sure of getting a representative elected who would support him in his illegal measures.

11. The second issue of the Declaration brought about the trial of the seven bishops, which further increased the breach between him and his people.

It speaks volumes for the self-restraint and inherent love of order of the Englishman that he continued to permit these illegal acts without having recourse to arms. But James was childless, and his successor would probably not be so autocratic, and so people's hopes were directed to the next reign. But when a son was born to the king—a son who would be educated in Stuart ideas and perpetuate the misgovernment—the nation as a whole revolted, and offered the crown to William of Orange and his wife Mary, the next heir to the throne. James had no class to support him; every one was glad to see him go, and his escape was connived at.

But the people of England had learned a lesson. The new king and queen were not allowed to mount the throne on a mere understanding that they would rule constitutionally; it was an opportunity which was promptly embraced to settle definitely once and for all time the exact prerogative of the sovereign. The document drawn up—the Declaration, afterwards Bill, of Rights—was hardly less important than the Magna Charta. It denied the right of the sovereign, without the consent of Parliament—(1) To levy taxes, (2) to suspend or dispense with laws, (3) to levy troops or keep up a standing army in time of peace, (4) to establish courts for ecclesiastical causes; and claimed the right of the subject—(1) to elect members of Parliament without interference, (2) to present petitions to the sovereign, (3) to have fair justice, and (4) to debate any matters freely in Parliament. This settled the main points at issue between Crown and people for centuries, and without unduly circumscribing the royal prerogative, placed on a firm and legal basis the rights and privileges of the subject.

The effects of the Revolution were far-reaching, as is shown by the legislation of, and the institutions which took their rise in, the subsequent reign.

The Mutiny Act of 1689 provided for a standing army for one year, and as it was necessary for the Commons to pass this every year, it gave them the power of disbanding the army if necessary. The Toleration Act of the same year granted freedom of worship to all except Roman Catholics. In the Succession Act several other important matters were decided. For example:—

1. The positions of importance in the Government were barred to foreigners.

2. Judges to hold their offices *quam diu se bene gesserint* (as long as they behaved themselves), but removable upon addresses from both Houses of Parliament. This had the effect of putting them above all outside influence, and rendered them independent of the goodwill of the King or Parliament.

3. No pardon under the Great Seal to prevent impeachment—that is, the notification of the king's forgiveness had no legal effect in stopping a defaulter being called to account.

Among some of the other important matters which resulted from the Revolution were—(1) Appropriation of supplies; (2) government by party; (3) the foundation of the National Debt and the Bank of England.

Appropriation of Supplies.—Up to this time the custom had prevailed of handing to the king all the money raised as national income. He disposed of the amounts to a great extent as his fancy dictated. Under the Stuarts much of it was thrown away on worthless favourites, and there was no means of checking the expenditure. But in 1690 the matter was carefully considered, and the income of the king was fixed in amount, and a certain amount appropriated for other purposes. Commissioners were appointed to audit and control the public accounts, and the system grew into the present one, when annually the House of Commons votes certain amounts for certain purposes—army, navy, civil service, etc.—and the money thus voted can only be spent for the particular purpose for which it was voted. This gives Parliament absolute control of the national expenditure.

Government by Party.—In Charles the Second's reign there were roughly two parties, one upholding the Crown, and the other pressing for such reforms as were carried out at the Revolution; they were nicknamed Tory and Whig, and these terms, first used in derision, came in all seriousness to designate the two chief political parties. Although at first not clearly indicated, it was the Whigs who were mainly supports of William's government, and, as was only natural, from them his chief ministers were chosen. The necessity of passing money Bills every year required that the ministers should have a majority in the House of Commons, and thus gradually the principle arose of choosing a ministry from that party commanding a majority, and also of making ministers directly responsible to Parliament for their actions, and of not allowing them to shelter themselves behind the Throne.

The National Debt.—As long as the king received all the income of the nation, he was responsible for its finance; and if money were required beyond that raised through the ordinary channels, he borrowed on his own responsibility, and repaid it when he could, or, as frequently in the case of the Stuarts, not at all. But now that the income was limited and Parliament assumed responsibility for financial affairs, it was unreasonable to expect the king to borrow, and William, whose tenure seemed by no means secure, would have found it difficult if he had attempted to do so. The coalition and wars against Louis the Fourteenth required a greater expenditure of money than could be immediately raised by taxation, and hence in 1694 a loan of £1,200,000 was raised by public subscription at 8 per cent., the interest of the subscribers being secured upon the taxes. On such terms money was readily forthcoming, and Parliament found it more and more convenient to raise money in this way. Thus was started the National Debt, which rapidly grew, and which is now well over £600,000,000. It is only fair to spread the repayment of any money expended for public good over a considerable term of years, and this principle is carried out in all municipal concerns of any magnitude. If a town, for example, spends £100,000 on a system of tramways which will be of benefit to succeeding generations, it is only fair that the latter should help to pay for them.

To carry out the financial operations of the Government the Bank of England was chartered, and at once became a national institution. Being under Government control it is absolutely safe, and the reason why a Bank of England note for £5 is accepted as readily as five sovereigns is simply because every one knows that the Bank is bound to keep a gold reserve equal

in amount to the notes in currency, so that should every one holding a note present it the same day, the payment is certain.

Such, briefly, are the chief results of the Revolution, not inaptly called "Glorious," since it settled with no bloodshed in England the disputes which had existed for centuries as to the relative rights of the three estates of the realm. We acquired a definite statement of privileges as citizens which were only obtained in France a century later at the cost of a total upheaval of the social fabric.

ESSAYS AND ESSAY WRITING.

Many of the essays which reach me give internal evidence that the subject has not been properly considered. In nearly all the subjects set it is necessary for the student to read up or think over the subject for some time to produce anything like a piece of good English. If an essay can be produced without preliminary thought, it is merely a waste of time writing it. Remember Cobbett's advice, "Sit down to write what you have thought, and not to think what you shall write." An essay, properly speaking, is the result of deliberation, of considering a subject from all points of view, in order to arrive at a correct opinion. This necessitates serious preparation, to young students more so than to those who have by continual practice acquired the mental habit of analysing and summing up the pros and cons of any topic of ordinary interest. The notes given below are merely suggestions of some of the thoughts which may naturally arise in connection with the subject, and should not necessarily be followed. I shall be glad at any time to criticise and return essays submitted, but they must be accompanied by a stamped addressed envelope and the coupon of the current number.

Write one or two essays each week on such subjects as the following:—

(*a*) Fire is a good servant but a bad master.
(*b*) Poverty in great cities.
(*c*) A school entertainment.
(*d*) Culture, its meaning and value.

Expand the substance of the following extracts into essays:—

(*e*) The single and peculiar life is bound,
With all the strength and armour of the mind,
To keep itself from noyance, but much more
That spirit upon whose weal depend and rest
The lives of many. The cease of majesty
Dies not alone.....Never alone
Did the king sigh, but with a general groan.

(*f*) The world is too much with us; late and soon,
Getting and spending, we lay waste our powers,
Little we see in Nature that is ours:
We have given our hearts away, a sordid boon!
This sea that bares her bosom to the moon,
The winds that will be howling at all hours,
And are upgathered now like sleeping flowers;
For this, for everything, we are out of tune;
It moves us not.

(*g*) Sweet are the uses of adversity,
Which, like the toad, ugly and venomous,
Wears yet a precious jewel in his head;
And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in everything.

(*h*) Give thy thoughts no tongue,
Nor any unproportioned thought his act.
Be thou familiar, but by no means vulgar.
The friends thou hast, and their adoption tried,
Grapple them to thy soul with hooks of steel.
Give every man thine ear, but few thy voice;
Take each man's censure, but reserve thy judgment.
Neither a borrower nor a lender be,
For loan oft loses both itself and friend,
And borrowing dulls the edge of husbandry.

Notes.

(*a*) Man is the only animal that can make and control fire. Point out the various uses made of fire and its effects, how important it is in the occurrences of everyday life, and what effects would accrue from its abolition. The necessity for keeping it under control and the damage it does when beyond control can be easily pointed out.

(*b*) It is undoubtedly a fact that the greatest poverty and distress is found in our great cities, and it seems to increase in proportion to the size of the city. Investigate the reasons for this. In the country, especially in the villages, the demand for labour is to a great extent fixed. The farmers employ the same number of men, and there is no occupation for any outside this number. Wages are also low, and the discontented man or the man out of work is naturally tempted by the higher rate of wages in towns to migrate thither, forgetting usually the increased expenses in rent, food, etc. Although in the towns there are greater numbers of vacant positions, there is always a much greater number of applicants, and it necessarily follows that there is a continual number of unemployed. Again, in the villages, where every one knows every one else, there is greater sympathy and mutual help; the loneliness of a great town is appalling. The problem and its solution is undoubtedly the most difficult at the present time.

(*c*) This is simply an exercise in description—hardly an essay, in the strict sense of the term—although the thoughtful student may find plenty of points to philosophise over.

(*d*) Define the term or explain it as clearly as you can. It is admittedly difficult of exact definition, for it is judged mainly in its results. It is the full cultivation of the higher æsthetic faculties of the mind which are frequently neglected. In such cases a beautiful picture, a lovely landscape, an exquisite passage of music or literature produce little or no pleasurable sensation, and a person lacking in culture is entirely unable to understand the joy evinced by the cultured man or woman, as a blind man cannot understand the pleasures of sight. Hence it not unfrequently happens that the term "culture" is used with a sense of contempt—the worthless contempt which arises out of sheer ignorance. But the value of culture to those who possess it is enormous: it adds greatly to the pleasure and enjoyment of life. There are many poems which to the uninitiated mean little, but which to a cultured mind are sources of keen and continual enjoyment. And so with all branches of art.

(*e*) This and the succeeding exercises are examples of extended paraphrase, with the difference that the writer is not tied down to the ideas presented in the original. The latter, of course, suggests a line of thought which should be followed and enlarged upon. This extract points out the difference in responsibility between the private individual and the man (not necessarily a king) upon whose actions depend the happiness of thousands. Increased power always entails increased responsibility.

(*f*) In this extract Wordsworth is pointing out what was true in his day, and still more so at the present time. The world *is* too much with us—that is, the human world. We spend an enormous time in considering the society around us—flattered by their empty praise, afraid of their censure, smarting under their strictures—and ignore the beauties of the natural world, which minister solely to our happiness, and never blame or annoy us.

(*g*) This well-known extract from *As You Like It* is something similar to the preceding, but goes beyond it in scope.

(*h*) Polonius's speech to his son Laertes in *Hamlet* contains much sound advice, which any father might give to his son—(1.) Think before speaking. (2.) Deliberate before acting. (3.) Be courteous to all, but not servile. (4.) Prefer a few trustworthy friends to a crowd of acquaintances. (5.) Listen to every one's opinion, but do not be in haste to state your own. (6.) Do not borrow and do not lend: in the latter case you will probably lose the money and the friendship of the borrower; in the former, you will not be relying on your own exertion.

Each of these sections can be amplified and explained. The exercise might take the form of a letter from father to son.

As usual, a small prize will be given for the best essays submitted during the month; the rules given above must be adhered to.

General Intelligence.

Answer the following questions. A book prize will be given for the best set sent in.

1. A space in a field is enclosed by 100 hurdles. Show by a diagram the shape if by the employment of two additional hurdles the space enclosed may be doubled.

2. A man left 17 camels to be divided among his sons in proportion of $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{9}$. An old chief whose advice was asked drove in one of his own camels. "Now," he said, "if you take $\frac{1}{2}$ of them or 9, *you* take $\frac{1}{3}$ or 6, and you $\frac{1}{9}$ or 2, you have each of you more than your share, and I have my own camel back." Point out the fallacy in this.

3. Where is the mistake in the following:—

$$x^2 - x^2 = x^2 - x^2$$
$$\therefore x(x - x) = (x - x)(x + x).$$ Cancel each side by $(x - x)$ and
$$x = x + x$$
$$x = 2x$$
$$1 = 2.$$

4. If a clock takes 30 seconds to strike 6, how long will it take to strike 12? (*N.B.*—The answer is *not* 60.)

5. Add the numbers 1 to 200. Explain your method clearly. The formula for Arithmetical Progression must not be used.

6. What is "perpetual motion"? Why is it impossible to devise a machine which will run perpetually?

7. Explain from what are the following metaphors taken:—

There were many candidates in the field.

He quickly took the cue.

The young doctor was a man of many talents.

The competition was well advanced when she entered the lists.

He showed a decided bias in his judgment.

8. Express in one word:—

(*a*) A shoulder-belt for carrying cartridges.

(*b*) An instrument for taking photographs.

(*c*) A doctor who devotes his work to animals.

(*d*) Drugs which render animals insensible to pain.

(*e*) A disturbance of the natural position of two bones at the point of contact.

(*f*) The organ by which an insect lays its eggs.

(*g*) One who wilfully sets fire to property.

(*h*) A cask containing 84 gallons.

PRELIMINARY CERTIFICATE, 1907.

Arithmetic.

The arithmetic paper consisted of fifteen questions, and one and three-quarter hours were allowed. All the questions might be attempted, but candidates were recommended "not to attempt more answers than they can do well." They were also warned that "their answers must be clearly and easily intelligible."

Generally speaking, it was a good paper for those students who had been trained to *think* and not to work by rule of thumb. The actual amount of working was in many cases very slight, but nearly every question demanded the ability to formulate rules and methods as necessary. Space prevents reproducing the whole of the questions, but the following are types which the student should always expect and be prepared for.

3. A boy is required to multiply £13, 3s. 7d. by 105. He multiplies by the factors 3, 5, 7 in order. In this way he gets 3 products. Explain how many times £13, 3s. 7d. the sum of these three products will be. Using addition and subtraction only, show how to find £13, 3s. 7d. × 93 from the products in the boy's sum.

7. State clearly why the answers suggested to the following sums are *obviously* wrong:—

(*a*) 7643 × 9009 Ans. 68856787.

(*b*) Simplify

$$\frac{\frac{1}{12}\text{ of 1 kilometre} - 11\text{ metres} + 320\text{ centimetres}}{\frac{1}{5}\text{ of 35 decimetres} + \frac{1}{2}\text{ of 7 metres}}.$$

Ans. 348 centimetres.

(*c*) The average age of the 169 boys in a school is 10 years 1 month, while the average for the 374 boys and girls is 9 years 3 months. Find the average age for the girls.

Ans. 9 years 7 months.

(*d*) Simplify $\dfrac{85\frac{2}{3}\frac{2}{6} - 4\frac{3}{7}\frac{7}{7}}{876\frac{4}{11}\frac{5}{3} + 24\frac{7}{11}\frac{7}{2}}$.

Ans. Any quantity greater than ·09

The answer to (*a*) is impossible, because it is not divisible by 9.

The answer to (*b*) is impossible, because measure divided by measure gives an abstract number—for example, 6 inches ÷ 3 inches = 2, and *not* two inches.

(*c*) is wrong. If the boys are 10 years 1 month and the girls 9 years 7 months as suggested, the average age must lie between the two ages.

(*d*) The fraction is approximately $\frac{5\cdot5}{5\cdot5\cdot5}$. ·09 is $\frac{5\cdot4}{5\cdot5\cdot5}$.

15. Work as clearly as possible, by the shortest method you can think of, the following:—

(*a*) Find the cost of 87 yards at 7s. 7d. a yard, together with double the number of yards at 1s. 2½d. a yard.

(*b*) Find the cost of 8 yards at 2s. 10½d. a yard.

(*c*) Find the distance travelled in 19 minutes at the rate of 42 miles per hour.

(*d*) Evaluate $49\frac{7}{11}$ of half a mile.

(*e*) Evaluate $\dfrac{99 - \frac{1}{11}\frac{7}{7}}{44 - \frac{4}{9}\frac{4}{9}}$.

Answers—

(*a*) = 87 yards at 7s. 7d. + 87 at 2s. 5d. = 87 at 10s. = £43, 10s.

(*b*) = 2s. 10½d. × 8 = 8 half-crowns = £1 + $\frac{8}{20}$ of £1 = £1, 3s.

(*c*) 60 minutes for 42 miles = 1 minute for $\frac{7}{11}$ mile; 19 = 13·3.

(*d*) $49\frac{7}{11}$ of half a mile = $24\frac{3}{4}\frac{3}{4}$ miles = 24 miles 1265 yards.

(*e*) The object is to get rid of large fractions. Multiply numerator and denominator by 111.

$$= \frac{111 \times 99 - 29\frac{1}{2}}{111 \times 44 - 13}, \text{ etc.}$$

In preparing for such an examination, the student must not only understand the principles underlying the various rules, but must be able to modify them to suit particular questions, and be quick to see the shortest way to the answer. This can only be done by continually working such examples. We propose to set occasionally specimen papers for solution. Students frequently complicate working by unnecessarily working out details or making reductions. Take, for example, Question 14: "Find the simple interest on a million pence for 12 years at 5 per cent." Reduction is unnecessary at first. The interest will clearly be 60 pence on the hundred or 600,000 pence on a million = 50,000 shillings = £2,500.

Composition.

One and a quarter hours was allowed for this exercise.

Write a short essay describing the way in which you would spend a summer holiday of a month if you were given £20 for the purpose.

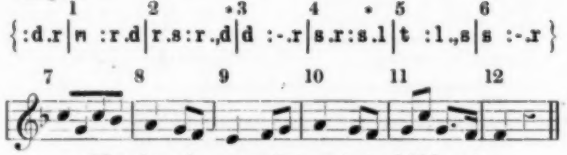
Drawing.

The copy, for which two hours were allowed, consisted of two intersecting spirals with rose foliage, and was not by any means difficult.

Music.

The paper was as follows:—

Key F.



(The above is one continuous tune of 12 bars.)

1. Write out the first six measures in Staff Notation. Write the time signature.

2. Write the last six bars in Sol-fa Notation.

3. Write out the first six bars (written in the imperfect method), introducing a bridge note between * and * indicating a one key remove.

4. Write the last six bars in ¼ time, doubling the value of each note or rest, and put it into the key of A (a major 3rd higher). Write the new key signature.

5. Write out either in Staff or Sol-fa a passage in ¼ time (or four-pulse measure) on a single note, giving at least three separate and different instances of syncopation.

The orthography test was as follows:—

Rewrite the following passage, correcting mistakes in spelling, punctuation, grammar, and language:—

As the day drew on towards twylight, the position of the Scotish army became increasingley difficult. Surounded as they were by ennemies who they knew to be superior in strength than themselves, their seemed little doubt as to the ultimat issue. But danger did not effect their spirit, the emergancy served only to call fourth new resources of courage and endurence, time after time the English cavallery swept up the slope in overwelming numbers, time after time they retreeted in confusion, leaving the Scotch line thinned, perhaps but undefeited. The strain, however, was too greater than undisiplined troupes could bare long: and towards evening the Highland cheiftain derived at a sudden desision. He siezed a favourable oportunity when the attention of the English was deverted and sallied from the wester end of his intrenchments with the handfull of men that was survived in a final attempt to cut his way out. The resistence was but half-hearty. The English general being not ill-pleased to let so formidible an oponent go free without farther damage to himself, although some would have wished to have pursued him. So under the shaddow of night the dauntless Scot past from the feild of battle and turned his face to the mountains where his one hope laid.

We shall be pleased to give a small prize to the first student sending up an entirely correct rendering of this passage.

Our Science Section.

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PHYSIOGRAPHY.

(STAGES 2 AND 3.)

Determination of H.—In order to determine the value of the horizontal component of the earth's magnetism two experiments are performed. We shall deal with the apparatus usually used in an ordinary physical laboratory rather than with the more complicated apparatus used in the observatories.

The horizontal component of the earth's magnetism is generally represented by the letter H, and this is the symbol we shall employ.

In the first experiment we measure the angle through which a small magnetic needle is deflected from the meridian by means of a bar magnet placed at a distance from it, and with its axis at right angles to the meridian and its axis produced passing through the centre of the needle. To make the reasons for the various steps clear we will first explain some of the terms we shall employ, and establish the formula used in the calculation.

If we take a right-angled triangle ABC (Fig. 1), and represent the angle ABC by θ, then the ratio of the length of the side AC (opposite the angle θ) to the hypotenuse AB is called *the sine of the angle* θ, and is usually written sin θ.

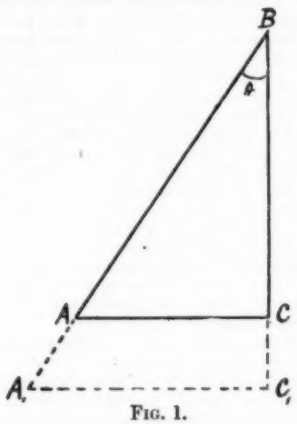


FIG. 1.

This ratio will always be the same for the same angle, as will be evident from the following consideration. If BA be produced to A, and from A_1 a perpendicular is let fall on BC produced, meeting it in C_1, the ratio of A_1C_1 to A_1B is the same as the ratio of AC to AB, since the two triangles ABC and A_1BC_1 are similar. In the same way the ratio of BC (the side adjacent to the angle θ) to the hypotenuse will be constant. This ratio is called *the cosine of the angle* θ, and is usually written cos θ. The ratio of AC to BC is called the tangent of the angle θ, and is written tan θ. It will be seen that $\frac{\sin\theta}{\cos\theta} = \tan\theta$, for

$$\frac{\sin\theta}{\cos\theta} = \frac{AC}{AB} \div \frac{BC}{AB} = \frac{AC}{AB} \times \frac{AB}{BC} = \frac{AC}{BC},$$

which by our definition is tan θ.

By the *magnetic field of a magnet*, it will be remembered, we mean the whole space through which the magnetic influence of the magnet is exercised, and by the *strength of the magnetic field* at any point we mean the force (measured in dynes) which that field would exert on a unit magnetic pole placed at that point.

By the *magnetic moment of a magnet* we mean the moment which that magnet would experience if placed in a field of unit intensity and at right angles to the lines of force, or we may define the magnetic moment of a magnet as the product of the pole strength m into l, the distance between the poles. The magnetic moment of a magnet is generally represented by M, and so $M = ml$.

When a magnetic field is of the same strength at all points, we speak of it as being a uniform magnetic field. Over any one small area the earth's horizontal field may be regarded as uniform, and the lines of force parallel to each other.

In Fig. 2 let the vertical dotted lines represent the direction

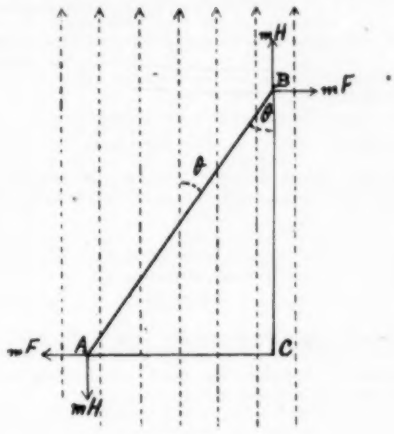


FIG. 2.

of the lines of force due to the earth's horizontal field, and let AB represent a magnetic needle with its poles at the ends A and B, and held in the position represented, making an angle with the direction of the lines of force. There will be a tendency for the needle to turn into the meridian, and this will be the same no matter what agency is used for holding it in the position shown.

If the strength of the field is represented by H, this means that the field will exert a force of H dynes on a unit pole placed in it. If the strength of the pole B is m, then the force exerted on it is mH dynes. Since the pole A is equal in strength to B, there will also be a force mH on this pole, but acting in the opposite direction. Hence we have two equal parallel forces acting on the needle in opposite directions, and not acting in the same straight line. We have therefore a true mechanical couple acting on the needle, and tending to turn it into the meridian. The moment of the couple will be one of the forces multiplied by the perpendicular distance between them—that is, mH × AC.

If we multiply and divide AC by AB, we shall not alter its value—that is, $AC = AB \times \frac{AC}{AB}$, but $\frac{AC}{AB}$ is the sine of the angle ABC or θ, and AB is the length of the magnet AB or l, hence

$$AC = AB \sin\theta = l \sin\theta.$$

Substituting this value of AC in the expression mH × AC, we get mH × l sin θ as the moment of the couple tending to bring the needle back into the meridian. This may be rewritten mlH sin θ, or MH sin θ. This will be the moment of the couple due to the field H, no matter what means are used to hold the needle in this position.

We will next suppose that the needle is held in this position by means of a uniform magnetic field of strength F at right angles to the field H. This field may be due to a magnet or a coil of wire carrying a current. If the strength of this field is expressed by F, this means that it will exert a force of F dynes on a unit pole, and therefore a force of mF dynes on the pole B, which is of m units. A similar force will be exerted on the pole A in a direction opposite to the direction of the force on B, but parallel to it. The moment of the couple due to the field F will therefore be mF × BC.

Now $BC = AB \cdot \frac{BC}{AB}$, but $\frac{BC}{AB}$ is the cosine of the angle θ, and $AB = l$, $\therefore$ $BC = l \cos \theta$. The moment of the couple due to F will therefore be $mF.l \cos \theta$, or $ml.F \cos \theta$, or $MF \cos \theta$. This couple is tending to turn the needle from the meridian, and is thus opposing the couple $MH \sin \theta$.

Suppose the needle is at rest in the position shown while under the influence of these two couples only, then we know that for that position the moments of the two couples are equal, and we may equate them thus—

$$MF \cos \theta = MH \sin \theta.$$

M is common to the two sides, and therefore $F \cos \theta = H \sin \theta$,

$$\text{or } F = H \frac{\sin \theta}{\cos \theta} = H \tan \theta.$$

Here we have an equation by means of which we are able to compare the strengths of the two fields simply by reading the angle of deflection, and taking its tangent from a table of tangents. In the next step we will calculate the strength of the field at a point on the axis of a magnet produced to some considerable distance from the magnet.

In Fig. 3 let NS represent a bar magnet and A a point on its axis produced. Let $\frac{l}{2}$ or λ be the distance from the centre of the magnet to the north pole N, and let d represent the distance from the centre of the magnet to the point A, then $AN = (d - \lambda)$, and $AS = (d + \lambda)$.

FIG. 3.

To calculate the strength of the field at the point A, we have to find the force exerted on a unit pole placed there. Suppose, then, a unit north pole is placed at A, and that the strength of each of the poles N and S is m.

The force exerted on the unit pole at A by the pole N will be the product of the strengths of the two poles divided by the square of the distance between them—that is,

$$\frac{m \times 1}{(d - \lambda)^2} = + \frac{m}{(d - \lambda)^2}.$$

The force due to the pole S will be

$$- \frac{m}{(d + \lambda)^2},$$

the negative sign being used because the force is one of attraction, and therefore opposite in direction to the force due to N. The resultant force acting on the pole at A will therefore be

$$\frac{m}{(d - \lambda)^2} - \frac{m}{(d + \lambda)^2}.$$

We will now simplify this expression.

$$\frac{m}{(d - \lambda)^2} - \frac{m}{(d + \lambda)^2} = m \left\{ \frac{1}{(d - \lambda)^2} - \frac{1}{(d + \lambda)^2} \right\}$$

$$= m \left\{ \frac{(d + \lambda)^2 - (d - \lambda)^2}{(d + \lambda)(d - \lambda)(d + \lambda)(d - \lambda)} \right\}$$

$$= m \left\{ \frac{(d^2 + \lambda^2 + 2d\lambda) - (d^2 + \lambda^2 - 2d\lambda)}{(d^2 - \lambda^2)(d^2 - \lambda^2)} \right\}$$

$$= m \left\{ \frac{d^2 + \lambda^2 + 2d\lambda - d^2 - \lambda^2 + 2d\lambda}{(d^2 - \lambda^2)^2} \right\}$$

$$= m \left\{ \frac{4d\lambda}{(d^2 - \lambda^2)^2} \right\} = \frac{2d \cdot m2\lambda}{(d^2 - \lambda^2)^2}.$$

But $2\lambda = l$, the length of the magnet, and therefore $m2\lambda = ml = M$.

Hence the expression becomes $\frac{2dM}{(d^2 - \lambda^2)^2}$.

This then represents the strength of the field at the point A. Call this F, then we can say $F = \frac{2Md}{(d^2 - \lambda^2)^2}$.

Next suppose that the axis of the magnet is at right angles to the meridian. The direction of the lines of force due to the field F at the point A will be at right angles to the lines of force due to the earth; and if the distance d is considerable, we may assume that for a short distance around A the field F is uniform. Let us then place a *short* magnetic needle at the point A. When the needle comes to rest under the action of the two fields, it will make an angle with the meridian. We have then the conditions represented in Fig. 2. Represent the angle through which the needle is deflected from the meridian by θ, then we may say,

$$\text{since } F = H \tan \theta,$$

$$\text{and } F = \frac{2Md}{(d^2 - \lambda^2)^2},$$

$$\text{that } \frac{2Md}{(d^2 - \lambda^2)^2} = H \tan \theta,$$

$$\text{or } \frac{M}{H} = \frac{(d^2 - \lambda^2)^2}{2d} \cdot \tan \theta.$$

Now, if λ is very small compared with d, we may neglect λ^2 without introducing any great error; then we may write

$$\frac{M}{H} = \frac{(d^2)^2}{2d} \cdot \tan \theta = \frac{d^3}{2d} \tan \theta,$$

$$\text{or } \frac{M}{H} = \tfrac{1}{2}d^2 \tan \theta.$$

If, then, we arrange an apparatus so that we can read off the distance d and the angle θ (the tan is taken from the tables), the right-hand side of the equation becomes a definite and known figure, and we get a value for $\frac{M}{H}$.

(To be continued.)

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

Preparation of small Quantities of Chromium for Lecture Experiments.—In order to demonstrate the preparation of chromium, 50 grams of potassium dichromate, which has been melted and powdered, is mixed with 18 grams of well-dried aluminium powder, and 20 grams of this powder incorporated with 100 grams of a mixture of 160 grams of dry aluminium powder with 450 grams of calcined chromium oxide. The mass is ignited by means of a mixture of barium peroxide and aluminium powder and magnesium ribbon. The yield varies from 50 to 75 per cent., and is better when larger quantities are used. In the latter case the proportion of the first mixture may be reduced to 10–15 grams.

Standardisation of Acids and Alkalis.—Crystallised borax has been recommended for the standardisation of mineral acids or alkalis on account of its unalterable composition. When used for acids, with methyl-orange as indicator, it acts like a known weight of sodium oxide, and therefore represents a known amount of the acid; when mixed with glycerol, half of the boric acid is set free, which, with phenolphthalein as indicator, represents a definite quantity of alkali. Mannitol may be used instead of glycerol, but is less convenient.

A new Method for the Estimation of Halogens in Organic Compounds by Means of Metal-ammoniums.—Organic compounds containing halogen are found to react with metal-ammoniums, with conversion of all the halogen present into metallic halide. On this reaction is based the method of determining halogen. Ammonia is liquefied on to a weighed quantity of the substance (if liquid or soluble in liquid ammonia) contained in a large test-tube cooled by immersion in a mixture of solid carbon dioxide and acetone, and then small pieces of clean sodium added until a blue coloration indicates presence of excess. The ammonia is then allowed to evaporate, the excess of sodium oxidised by a current of moist air, and the halogen estimated as silver halide. If the substance is solid and insoluble in liquid ammonia, it is dissolved in ether, benzene, or toluene, and the solution treated with sodammonium.

The method seems to be as accurate as that of Carius, or heating with lime, and the advantages over the latter are rapidity and ease of manipulation.

Detection of Sulphites in the Presence of Thiosulphates and Thionates.—Solutions of normal sulphites readily destroy the colours of dilute solutions of certain triphenylmethane dyes, whereas solutions of thiosulphates or of di-, tri-, and tetrathionates do not. Solutions of mono- and poly-sulphides also remove the colour from the dye solutions, and the sulphide ion must be removed by means of zinc or cadmium ions before the test with the dye is made. The best effects are obtained by using a mixture of 3 vols. of magenta solution (0·25 gram in 1 litre) and 1 vol. of malachite-green solution of the same concentration. The colour is restored on the addition of a small amount of acetaldehyde. If the original solution is alkaline, carbon dioxide is passed in; if acid, an excess of sodium hydrogen carbonate is added. A solution of 0·00006 gram of sulphurous acid in 1 c.c. of water can readily be detected by this method.

Detection of Sucrose in Presence of Lactose.—A little of the sample is sprinkled over sulphuric acid, when any sucrose will rapidly char (Schmidt's method). By way of confirmation some other tests may be applied, such as Pinoff's test with alcoholic solution of resorcinol and sulphuric acid, which gives a red coloration in presence of sucrose. Cotton's test, the blue coloration produced on warming with molybdic acid in presence of dilute hydrochloric acid, is also trustworthy; also the red coloration obtained by agitating the sample with sesame oil and hydrochloric acid. Lorin's method, based on the fact that sucrose is readily charred on heating in a water-bath with dry oxalic acid, may also be recommended.

An Attempt by Lord Kelvin to explain the Radioactivity of Radium.—Assuming that there is a position of stable equilibrium for an electron near the boundary of an atom and another position at the centre, corresponding respectively with very small and very large potential energy, an explanation of radioactivity is suggested. An atom is termed *loaded* when an electron is contained within the range of stability of the central position, *unloaded* when no electron is present in this region. Starting out with a quantity of radium in which all the atoms are supposed to be unloaded, the equilibrium state corresponding with a permanent average of loadings and unloadings will require a certain interval of time. The energy required for the loading of the atoms is taken from the heat energy of the substance, which is thereby cooled, and takes up heat by conduction and radiation from surrounding matter. In the unloading of the atoms, electrons are projected out with enormous velocities. Those discharges which send the electrons towards the interior of the crystals of the radioactive substance will, by the recoil, send the unloaded atoms outwards with comparatively small velocity. The unloaded atoms, which are positively charged, constitute the α-rays. On account of the much greater velocities, the β-particles must be chiefly effective in the heat production observed.

Calcium as an Absorbent of Gases for the Production of High Vacua and Spectroscopic Research.—Frederick Soddy has shown that metallic calcium when heated to a sufficiently high temperature is a universal absorbent of all gases except those of the argon group. When the calcium is at its proper temperature, the chemically valent gases are very quickly absorbed; and if the apparatus is furnished with a Plücker tube for testing purposes, the vacuum tube becomes non-conducting within a minute after the introduction of several cubic centimetres of gas into the apparatus. In the case of hydrogen and its compounds, which yield calcium hydride on absorption, the real absorption temperature is apt to be overstepped. This is due to the dissociation tension of the calcium hydride. On lowering the temperature, however, this becomes sufficiently small to permit of a non-conducting vacuum being readily obtained. In the production of high vacuum by means of calcium, it is necessary to replace the air in the apparatus before the absorption takes place, or the residual argon will prevent the vacuum from being really good. The particular value of calcium as an absorbing agent depends upon its power of absorbing almost instantly the gases condensed on the glass walls as soon as these are expelled by heating. A low initial pressure, not exceeding a few mm. of mercury, is essential for the absorption process; and under proper working conditions the calcium should never be melted, although it may be completely volatilised and redeposited on the cooler parts of the apparatus.

Using metallic calcium as an absorbent for foreign gases, experiments have been made on the quantities of argon and helium which can be detected by the spectroscope. The results indicate that a discharge will not pass through a tube containing argon at a pressure less than one-fiftieth of a mm. The limiting pressure in the case of helium is one-twentieth of a mm. In the presence of other (chemically valent) gases very much smaller quantities of argon and helium can be detected by the discharge method.

This non-conducting power at pressures within the range of direct manometric measurement appears to be characteristic of monatomic gases, and the observed facts indicate that the electric discharge method may prove a very faulty guide in regard to the degree of a vacuum. Since the vapour pressure of mercury at room temperature is between one five-hundredth and one thousandth mm., the production of high vacua (as measured by the discharge method) by the aid of mercury pumps is probably due to the fact that mercury is monatomic.

Some experiments, in which quantities of helium far smaller than those necessary to allow the discharge to pass when in the pure state were examined in presence of hydrogen and oxygen, indicate that helium at a partial pressure of 0·0005 mm. can be detected spectroscopically. This is only one-hundredth of the partial pressure requisite in the case of pure helium.

MATHEMATICS.

(STAGES 2 AND 3.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mathematics, etc., Morley College; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

RATIO.—The section of algebra dealing with ratio is of great importance, not only in mathematics, but also in the many applications of mathematics to scientific and practical problems. The notation used, together with some of the simpler applications, is probably already familiar to the reader; and as detailed information may be obtained from any text-book on algebra, it will only be necessary to give here a brief summary of some of the more important results.

For example, $\frac{a}{b} = \frac{c}{d}$, which is read as *the ratio of* a *to* b *equals the ratio of* c *to* d, may be made to assume various forms by algebraic manipulation. Thus by adding and subtracting unity from both sides we may obtain $\frac{a+b}{a-b} = \frac{c+d}{c-d}$. This relation is of great value in dealing with certain types of equations. Various other forms may be obtained in a similar manner.

The equality of two ratios, such as $2 : 4 = 8 : 16$, read as 2 is to 4 equals 8 to 16, is called *proportion*.

Variation.—The sign $\propto$ of variation indicates that one quantity varies as, or is proportional to, another. Thus the condition that x varies directly as y and inversely as z would be written as $x \propto \frac{y}{z}$, or it may be expressed in a much more convenient form by introducing a constant, and is then written as $x = k\frac{y}{z}$, where k is a constant. The value of k can be obtained when simultaneous values of x, y, and z are known, and when the value of k has been found. Then for given values of any two of the three variables the remaining quantity can be obtained.

Ex. 1. If x varies as the square of y, and if x equals 144 when y equals 3, find the value of y when x equals 324. (1899.)

If x varies as the square of y, then $x = ky^2$ (i), where k is some constant. The value of k can be found by substituting the given values. Thus $144 = 9k$.

$$\therefore k = \frac{48}{3}.$$

Hence to find y when $x = 324$, this value of k may be substituted in (i).

$$\therefore 324 = \frac{48}{3}y^2.$$

$$\therefore y^2 = \frac{324 \times 3}{48} = \frac{81}{4},$$

$$\text{or } y = \frac{9}{2}.$$

Ex. 2. (*a*) State what is meant when one quantity is said to vary as another quantity, and give an example.

(*b*) It is known that x varies directly as y and inversely as z; it is also known that x is 11 when y is 300 and z is 30. Find the value of y when x changes to 12 and z to 29·7. (1900.)

(*b*) The condition that x varies directly as y and inversely as z is expressed by

$$x \propto \frac{y}{z}, \text{ or } x = k\frac{y}{z}. \quad \ldots\ldots\ldots \text{(i)}$$

The value of the constant k is found by substituting the given values. Thus

$$11 = k \times \frac{300}{30}.$$

$$\therefore k = \frac{11}{10}.$$

To find the value of y we have from (i)

$$x = \frac{11}{10}\frac{y}{z}.$$

$$\therefore 12 = \frac{11}{10} \times \frac{y}{29{\cdot}7},$$

$$\text{or } y = \frac{12 \times 297}{11} = 324.$$

Ex. 3. (*a*) If a depends only on b and c, and if a varies as b when c is constant, and varies as c when b is constant, show that a will vary as bc when b and c both vary.

(*b*) It is known that x varies directly as y and inversely as z;

it is also known that x is 500 when y is 300 and z is 14. Find the value of z when x is 574 and y is 369. (1900.)

(b) The condition gives $x = k\frac{y}{z}$ (i), where k is a constant, the value of which can be obtained thus—

$$500 = k \times \frac{300}{14}.$$

$$\therefore k = \frac{500 \times 14}{300} = \frac{70}{3}.$$

Substituting in (i),

$$x = \frac{70}{3} \times \frac{y}{z}.$$

$$\therefore 574 = \frac{70}{3} \times \frac{369}{z},$$

$$\text{or } z = \frac{70 \times 369}{574 \times 3} = \frac{35 \times 123}{287} = 15.$$

Ex. 4. (a) Show that the area of a rectangle varies jointly as the sides which contain one of its angles.

(b) Explain clearly under what circumstances you are justified in saying that the area of a rectangle equals ab where a and b are the lengths of its sides.

(c) The area of a circle is 27 times that of a second circle. If the diameter of the latter circle is 5 feet, show that the diameter of the first circle is very nearly 26 feet.

[*N.B.*—Of course, the area of a circle varies as the square of the diameter.] (1906.)

(c) The relation is $A \propto d^2$, or $A = kd^2$, where A denotes the area, d the diameter of the circle, and k is a constant.

$$\therefore A = k \times 5^2 = 25k.$$

$$\therefore k = \frac{A}{25}.$$

$$A' = 27A = kd^2, \text{ or } d^2 = \frac{A'}{k}.$$

Substituting the value of k, then

$$d^2 = \frac{27A \times 25}{A}.$$

$$\therefore d = 5\sqrt{27} = 5 \times 3\sqrt{3}$$

$$= \frac{30\sqrt{3}}{2} = 25{\cdot}98 \text{ ft.}$$

—that is, d is nearly 26 ft.

Ex. 5. (a) If four quantities be proportional, show that the sum of the greatest and least is greater than the sum of the other two.

(b) Find the mean proportional of $1 + \sqrt{2}$ and $7 + 5\sqrt{2}$, first in the simplest surd form, and then in a decimal form, having given $\sqrt{2} = 1{\cdot}4142$. (1898.)

(b) Mean proportional

$$= \sqrt{(1 + \sqrt{2})(7 + 5\sqrt{2})} = \sqrt{(17 + 12\sqrt{2})}.$$

Let $\sqrt{(17 + 12\sqrt{2})} = \sqrt{x} + \sqrt{y}$.

Squaring, $17 + 12\sqrt{2} = x + y + 2\sqrt{xy}$.

$$\therefore x + y = 17.$$

Also $x - y = 1$.

Hence $x = 9$, $y = 8$.

$\therefore$ mean proportional $= 3 + 2\sqrt{2}$.

Ex. 6. If $a : b :: c : d$, show that $a^2 : b^2 :: a^2 - c^2 : b^2 - d^2$. (1899.)

Ex. 7. State what is meant by the ratio of two quantities of the same kind to each other, and give an example.

Find the ratio of $2\frac{2}{3}$ cubic feet to $\frac{1}{3}$ of a cubic yard, and state whether the ratio is one of greater or less inequality.

Show that a ratio of greater inequality is diminished by adding the same number to the antecedent and to the consequent. (1903.)

Ex. 8. (a) State what is meant by the notation $a : b :: c : d$.

(b) If $a : b :: c : d$, show that

$$a^2 + c^2 : b^2 + d^2 :: a^2 - c^2 : b^2 - d^2.$$

(c) Find in its simplest form the mean proportional to

$ac - bc + ad - bd$ and $ac + bc - ad - bd$.

Verify your result when a, b, c, d are respectively equal to 13, 12, 5, 4. (1903.)

Ex. 9. When are quantities said to be in continued proportion?

If five quantities, a, b, c, d, e, are in continued proportion, show that the ratio of the first to the last is the fourth power of any two consecutive quantities.

Show also that c is a mean proportional between a and e, and that $ab + bc + cd + de$ is a mean proportional between

$$a^2 + b^2 + c^2 + d^2 \text{ and } b^2 + c^2 + d^2 + e^2. \quad (1906.)$$

NOTES ON PHYSICS.

BY EDWIN EDSER, A.R.C.SC.,

Author of "Heat for Advanced Students," "Light for Students," "Differential and Integral Calculus for Beginners," etc.

The Ballistic Galvanometer.

When a steady current flows through a galvanometer a steady deflection is produced. In the case of a tangent galvanometer, the tangent of the angle of deflection is proportional to the current, and the same law applies to other forms of galvanometer in which a *small* suspended magnet is deflected by the field due to the current. When the angle of deflection is small, as in reflecting galvanometers, the tangent and the circular measure of the angle of deflection are practically equal, and therefore in these circumstances the deflection is proportional to the current.

In certain experiments a momentary current is sent through a galvanometer, and the throw of the needle is observed. In such circumstances the galvanometer is said to be used *ballistically*. It is necessary that certain conditions shall be complied with in order that a galvanometer may be used ballistically. These conditions are as follows:—

1. The time of swing of the needle must be so long that the throw of the needle can be accurately observed. In general the time of swing of the needle should amount to from five to ten seconds at least. If the time of swing is much more rapid than this, the spot of light on the scale will move so quickly that an accurate observation of the throw will be impossible.

2. The rush of current which is sent through the galvanometer must continue only for a very short time—a time so short that the needle does not move appreciably while the current is flowing.

Suspended coil galvanometers offer so many advantages over those of the suspended magnet type that they are now almost exclusively used. The advantages of a suspended coil galvanometer are:—

1. The control is due to a fine strip of metal, which also serves to carry the current into the coil. Hence the galvanometer can be set up facing in any required direction, while the position in which a suspended magnet galvanometer can be set up depends more or less on the direction of the earth's magnetic field.

2. A suspended coil galvanometer is not affected by bringing iron or magnets near to it; on the other hand, a suspended magnet galvanometer is affected not only by the presence of iron or magnets, but also by the magnetic field due to electric lighting currents and the currents used in neighbouring electric tramway systems.

3. The throw of a suspended coil galvanometer for a given discharge of electricity through it depends only on the torsional rigidity of the suspending strip, and therefore a galvanometer of this type, when once set up, can be calibrated once for all. The throw of a suspended magnet galvanometer for a given discharge of electricity depends on the magnetic field in which the suspended magnet swings, and any alteration in the value of the field will affect the throw. Hence a galvanometer of this type must be recalibrated practically every time it is used.

The following notes will apply more directly to the use of a suspended coil galvanometer for ballistic measurements; some slight modification would be necessary to make them apply to a suspended magnet galvanometer.

Time of Swing of the suspended Coil.—When a body is suspended by a metal wire or strip, it can be turned about the suspension axis by the application of a couple, or, as it is now generally called, a torque. A torque is produced when two equal and opposite forces act parallel to each other, but not in the same straight line: the value of the torque is equal to the product of either force into the perpendicular distance between the two. To twist the body about the suspending wire as axis, the two forces must obviously act in a horizontal plane. It is found that, for small angular twists, the angle through which the suspended body turns is proportional to the torque applied; hence for a given suspension the angular twist divided into the torque which produces it is a constant, which we shall call the *torque per unit twist*, and denote by τ_1.

Imagine a cylindrical body with its geometrical axis vertical, to be acted upon by two equal and opposite forces at opposite ends of a diameter. Let each force be numerically equal to f, while the diameter of the cylinder is equal to d. If the cylinder is turned through an angle θ in opposition to these forces,

each force is overcome through a distance equal to $\frac{d}{2}\theta$, and therefore the total work done against both forces is equal to

$$2 \times f \cdot \frac{d}{2} \cdot \theta = fd \cdot \theta.$$

Now fd is the torque which is overcome, and θ is the angular twist; hence *the work done is equal to the torque overcome multiplied by the circular measure of the twist.*

If the torque varies while the twist θ is being produced, the work done is found by multiplying the *average* value of the torque by the circular measure of the twist.

Now consider a body suspended by a fine wire or metal strip. In order to keep this body twisted from its natural position of rest, a torque proportional to the twist must be applied. This torque must be just equal to the torque which tends to bring the body back to its natural position of rest, due to the twisting of the suspending wire; hence the restoring torque due to the twisting of the wire is proportional to the twist, and the restoring torque per unit twist may be denoted by τ_1. When the body is twisted through an angle θ from its natural position of rest, the restoring torque will be equal to $\tau_1\theta$; and while the twist θ was being produced, the restoring torque varied from zero to its final value $\tau_1\theta$, so that the average value of the restoring torque must have been $(\tau_1\theta)/2$. This average torque is overcome through an angle θ, and therefore the work done is equal to

$$\frac{\tau_1\theta}{2} \times \theta = \tfrac{1}{2}\tau_1\theta^2.$$

This represents the potential energy of the suspended body when it has been twisted through an angle θ about the suspending wire as axis.

When the body has been twisted through the angle θ, let it be released. It commences to rotate toward its natural position of rest, and its potential energy is converted into kinetic energy. As the body moves through its position of rest its energy is solely kinetic, and has a value equal to the potential energy of the body at the instant when it was released. Now the body will be moving with simple harmonic motion, and therefore its angular velocity as it passes through its position of rest is equal to $2\pi\theta/T$, where T is the time of a complete oscillation. Hence, if I is the moment of inertia of the suspended body about the suspending wire as axis, the kinetic energy of the body as it passes through its position of rest is equal to

$$\tfrac{1}{2}\mathrm{I} \times (\text{angular velocity})^2 = \tfrac{1}{2}\mathrm{I}\left(\frac{2\pi\theta}{\mathrm{T}}\right)^2,$$

and this is equal to the potential energy of the body at the instant when it was released; therefore

$$\tfrac{1}{2}\mathrm{I}\left(\frac{2\pi\theta}{\mathrm{T}}\right)^2 = \tfrac{1}{2}\tau_1\theta^2.$$

$$\therefore \mathrm{T} = 2\pi\sqrt{\frac{\mathrm{I}}{\tau_1}}. \quad . \quad . \quad . \quad . \quad . \quad (1)$$

This result gives the time of vibration of a suspended coil galvanometer, if I is the moment of inertia of the coil about the suspending wire as axis, and τ_1 is the value of the torque that would twist one end of the suspending wire through unit angle (one radian), the other end of the wire being fixed.

In order to make T large, it is necessary either to make I large or to make τ_1 small. If the moment of inertia of the coil is made very large, the coil must be heavy, and a strong suspending wire or strip will be needed; this, of course, tends to diminish the sensitiveness of the galvanometer. It is better to use a coil of fairly small mass and a suspension with little torsional rigidity; for this reason a strip is better than a wire, since the opposing torque called into play by a given twist is less for a strip than for a circular wire of the same sectional area, and therefore of the same strength.

Throw produced by the Discharge of a given Quantity of Electricity.—Let us suppose that a given quantity, Q, of electricity is discharged through the coil. The current flowing through the coil at any instant produces a torque which tends to deflect the coil, and therefore communicates kinetic energy to the coil. The energy communicated to the coil is equal to the work done by the deflecting torque; and as the torque varies with the current, the average deflecting torque is proportional to the average current. Let the discharge occupy a time, t, which is very small in comparison with T; then if unit current produces a torque, τ, the average current, Q/t, will produce a torque, $\tau Q/t$. When the current ceases, let the coil possess sufficient kinetic energy to produce a throw of θ radians; then the coil is moving through its position of rest, and the amplitude of the angular oscillation is equal to θ, and therefore the angular velocity of the coil is equal to $2\pi\theta/T$. While the current lasted the velocity increased from zero to $2\pi\theta/T$, and therefore the average velocity during the time t was $\frac{1}{2} \cdot \frac{2\pi\theta}{\tau}$, and in this time the coil turns through a very small angle equal to

$$\tfrac{1}{2} \cdot \frac{2\pi\theta}{\tau} \cdot t.$$

Multiplying this angular twist by the average deflecting torque $\tau Q/t$, we obtain the energy communicated to the coil; and equating this to the kinetic energy of a body with moment of inertia I, passing through its position of rest during a simple harmonic motion of angular amplitude θ and period T, we obtain

$$\frac{\tau Q}{t} \cdot \tfrac{1}{2} \cdot \frac{2\pi\theta}{\tau} \cdot t = \tfrac{1}{2}\mathrm{I}\left(\frac{2\pi\theta}{\mathrm{T}}\right)^2.$$

$$\therefore \tau Q = \mathrm{I}\frac{2\pi\theta}{\mathrm{T}},$$

$$\text{and } Q = \frac{\mathrm{I}}{\tau} \cdot \frac{2\pi}{\mathrm{T}} \cdot \theta. \quad . \quad . \quad . \quad . \quad . \quad (2)$$

We also have the relation given by equation (1) above. Substituting the value of I obtained from (1) in (2) we have

$$Q = \frac{\tau_1}{\tau} \cdot \frac{\mathrm{T}}{2\pi}\theta. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Now τ_1 denotes the restoring torque called into play per unit twist of the suspending strip, and τ denotes the deflecting torque per unit current flowing through the coil; hence τ_1/τ is a constant for a given galvanometer. The value of this constant may be put in a more convenient form. The deflection ϕ produced by a steady current is proportional to the current, so that we may write

$$\phi = k\mathrm{C}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

where k is the deflection per unit current. Now the current C will produce a deflecting torque τC, and the deflection ϕ will produce a restoring torque equal to $\tau_1\phi$, and these two must be equal; hence

$$\tau\mathrm{C} = \tau_1\phi,$$

$$\text{and } \frac{\tau_1}{\tau} = \frac{\mathrm{C}}{\phi} = \frac{1}{k}, \text{ from (4).}$$

Substituting the value of τ_1/τ in (3), we have

$$Q = \frac{1}{k} \cdot \frac{T\theta}{2\pi},$$

from which the value of Q can be determined when we know the value of k, and observe the values of T and θ.

THE ST. GEORGE'S CLUB FOR BOYS AND GIRLS.

THE members of the above club, whose motto is "Onward and Upward," promise—

1. To befriend, where possible, those who are in need—the weak, the poor, and the aged.

2. Not to torture any dumb animal, nor to rob a bird's nest.

3. Not to wantonly destroy wild flowers.

4. Not to scatter paper, or other unsightly things, in beautiful spots.

5. Not to throw orange-peel or banana-skins on the pavement, and to remove any thoughtlessly left there by others.

The organ of the club, which all boys and girls of our primary schools ought to join, is the *St. George's Magazine*, issued from St. George's House, Eastcheap, London, E.C. The January number of this very attractive penny monthly lies before us, and we honestly think it the best pennyworth of the kind that we have ever seen, both for reading matter and general get-up. Many scholars' monthlies are unattractive to the eye, but the *St. George's Magazine* is a thing of beauty, with its bright scarlet-and-green cover, good paper, and excellent illustrations. The charming four-page Infants' Supplement ought to be seen by all teachers of the "sixes."

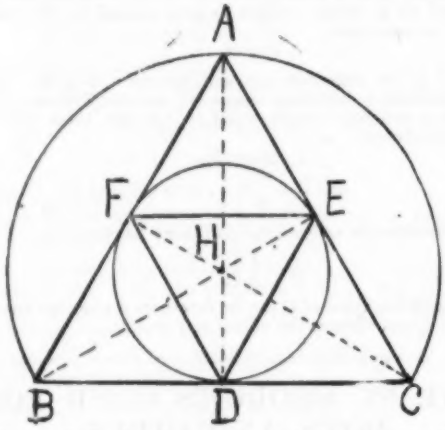
OUR QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the name and address of the correspondent, and the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

Vergilius.—In a given circle is inscribed an equilateral triangle, and in that triangle another circle, and so on *ad infinitum*. Show that the sum of the circumferences of all the inner circles is equal to that of the given circle, and the sum of their areas to a third of its area. (Mann's *Mensuration*.)



Let ABC be the given circle, and the triangle ABC an inscribed equilateral triangle. Take D, E, F, the middle points of AB, BC, CA. Join AD, BE, CF.

By a well-known theorem the medians AD, BE, CF intersect in the same point H, which is a point of trisection of each of the medians.

Again, since ABC is an equilateral triangle, it is easily seen that H is the centre of the given circle ABC. Also HD, HE, HF are equal to one another, and are respectively perpendicular to BC, CA, AB. Hence the circle DEF is inscribed in the triangle ABC.

Again, since HD is one-third of AD, therefore HD is one-half of HA. Hence the radius of the circle DEF is one-half the radius of the circle ABC. In the same way the radius of the third circle will be one-half that of the circle DEF, and so on. Hence if $2\pi r$ is the circumference of the first circle, the circumferences of the inner circles will be

$$2\pi\frac{r}{2},\ 2\pi\frac{r}{4},\ 2\pi\frac{r}{8},\ \text{etc.}$$

The sum of the circumferences of the inner circles will be

$$2\pi\left(\frac{r}{2}+\frac{r}{4}+\frac{r}{8}+\ldots\text{ ad inf.}\right)$$
$$=2\pi r\cdot\frac{1}{2}\frac{1}{1-\frac{1}{2}}=2\pi r.$$

Again, if πr^2 is the area of the given circle, the sum of the areas of the inner circles will be

$$\pi\left\{\left(\frac{r}{2}\right)^2+\left(\frac{r}{4}\right)^2+\left(\frac{r}{8}\right)^2+\ldots\text{ ad inf.}\right\}$$
$$=\pi r^2\left(\frac{1}{4}+\frac{1}{16}+\frac{1}{64}+\ldots\text{ ad inf.}\right)$$
$$=\pi r^2\cdot\frac{1}{4}\cdot\frac{1}{1-\frac{1}{4}}=\frac{\pi r^2}{3}.$$

Hague.—A cannon being pointed towards the top of a tower, the ball is seen to strike, after t seconds, a point of the tower on the same horizontal line with the cannon. The cannon being reloaded with a different charge and raised to twice its former angle of elevation, the ball is observed to strike the top of the tower after T seconds. To find the distance of the tower from the cannon.

(Walton's *Problems in Theoretical Mechanics.*)

Let O be the position of the cannon, PN the tower, ON being horizontal. Let PON, the angle of elevation at the first discharge, be denoted by α. Then RON, the angle of elevation at the second discharge, must be denoted by 2α. Denote ON by x.

From the formula for the range of a projectile on a horizontal plane through the point of projection, we have—

$$x=\frac{u^2\sin 2\alpha}{g},\quad\ldots\ldots\quad(1)$$

where u is the velocity of the first shot.

$$\text{But } u=\frac{x}{t\cos\alpha}.$$
$$\therefore x=\frac{x^2}{t^2\cos^2\alpha}\cdot\frac{\sin 2\alpha}{g}.$$
$$\therefore x=\frac{x^2\,2\sin\alpha\cos\alpha}{t^2\cos^2\alpha g}.$$
$$\therefore 2x=gt^2\cot\alpha.\quad\ldots\ldots\quad(2)$$

Again, from the formula for the range of an inclined plane through the point of projection, we have for OP

$$\text{OP}=\frac{2V^2\cos 2\alpha\sin(2\alpha-\alpha)}{g\cos^2\alpha},$$

where V is the velocity of the second shot.

$$\text{But } V=\frac{x}{T\cos^2\alpha},\ \text{and OP}=\frac{x}{\cos\alpha}.$$
$$\therefore\frac{x}{\cos\alpha}=2\frac{x^2}{T^2\cos^2 2\alpha}\cdot\frac{\cos 2\alpha\sin\alpha}{g\cos^2\alpha}.$$
$$\therefore x=\frac{2x^2}{T^2\cos 2\alpha}\cdot\frac{\tan\alpha}{g}.$$
$$\therefore x=\frac{gT^2\cos 2\alpha\cot\alpha}{2}.\quad\ldots\ldots\quad(3)$$

Taking (3) from (2) we have

$$x=g\cot\alpha\left(t^2-\frac{T^2\cos 2\alpha}{2}\right).\quad\ldots\quad(4)$$

From (2) we have

$$\frac{2x}{g}\tan\alpha=t^2.$$

From (3) we have

$$\frac{2x}{g}\tan\alpha = T^2\cos 2\alpha.$$

$$\therefore T^2\cos 2\alpha = t^2.$$

$$\therefore \cos 2\alpha = \frac{t^2}{T^2}$$

Hence (4) may be written

$$x = g\cot\alpha\left(t^2 - \frac{t^2}{2}\right) = \tfrac{1}{2}gt^2\cot\alpha. \quad . \quad . \quad . \quad (5)$$

Again, since $\cos 2\alpha = \frac{t^2}{T^2}$,

$$\therefore 1 - 2\sin^2\alpha = \frac{t^2}{T^2}.$$

$$\therefore \sin^2\alpha = \frac{T^2 - t^2}{2T^2}.$$

$$\text{But } \cot^2\alpha = \frac{1}{\sin^2\alpha} - 1.$$

$$\therefore \cot^2\alpha = \frac{2T^2}{T^2 - t^2} - 1.$$

$$\therefore \cot^2\alpha = \frac{T^2 + t^2}{T^2 - t^2}.$$

Hence (5) may be written

$$x = \tfrac{1}{2}gt^2\left(\frac{T^2 + t^2}{T^2 - t^2}\right)^{\frac{1}{2}}.$$

The required distance is therefore $\frac{1}{2}gt^2\left(\frac{T^2 + t^2}{T^2 - t^2}\right)^{\frac{1}{2}}$.

W. H. E.—Eliminate x, y, and z from the equations

$$\frac{x^4}{a^{\frac{1}{2}}b^{\frac{1}{2}}} + \frac{y^4}{a^{\frac{1}{2}}b^{\frac{1}{2}}} = mz^2,$$

$$\frac{x^{\frac{1}{2}}}{(az)^{\frac{1}{4}}} = x + y = \frac{y^{\frac{1}{2}}}{(bz)^{\frac{1}{4}}};$$

and show from the result $\left[\left(\frac{a}{b}\right)^{\frac{1}{12}} + \left(\frac{b}{a}\right)^{\frac{1}{12}} = m^{\frac{1}{6}}\right]$ that if $\frac{a}{b}$ is possible, m cannot be less than 2^6.

$$\text{Since } \frac{x^{\frac{1}{2}}}{(az)^{\frac{1}{4}}} = \frac{y^{\frac{1}{2}}}{(bz)^{\frac{1}{4}}},$$

$$\therefore \frac{x^6}{az} = \frac{y^6}{bz}.$$

$$\text{Hence } x = \left(\frac{a}{b}\right)^{\frac{1}{6}}.y. \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$\text{Again, since } \frac{y^{\frac{1}{2}}}{(bz)^{\frac{1}{4}}} = x + y = y\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\},$$

$$\therefore \frac{y^6}{bz} = y^4\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^4.$$

$$\therefore \frac{y^2}{bz} = \left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^4.$$

$$\text{Hence } z^2 = \frac{y^4}{b^2\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^8}. \quad . \quad . \quad (2)$$

Substituting in the first of the given equations the values of z and x obtained in (2) and (1), we have

$$\frac{\left(\frac{a}{b}\right)^{\frac{1}{3}}y^4}{a^{\frac{1}{2}}b^{\frac{1}{2}}} + \frac{y^4}{a^{\frac{1}{2}}b^{\frac{1}{2}}} = \frac{my^4}{b^2\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^8};$$

and this reduces to

$$\left(\frac{a}{b}\right)^{\frac{1}{3}}\left(\frac{b}{a}\right)^{\frac{1}{2}} + \left(\frac{b}{a}\right)^{\frac{1}{2}} = \frac{m}{\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^8}.$$

$$\text{Hence } \left(\frac{b}{a}\right)^{\frac{7}{12}} + \left(\frac{b}{a}\right)^{\frac{1}{2}} = \frac{m}{\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^8}.$$

$$\therefore \left(\frac{b}{a}\right)^{\frac{1}{12}}\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\} = \frac{m}{\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^8}.$$

$$\therefore \left(\frac{b}{a}\right)^{\frac{1}{12}}\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\}^9 = m.$$

$$\therefore \left(\frac{b}{a}\right)^{\frac{1}{12}}\left\{\left(\frac{a}{b}\right)^{\frac{1}{6}} + 1\right\} = m^{\frac{1}{9}}.$$

$$\therefore \left(\frac{a}{b}\right)^{\frac{1}{12}} + \left(\frac{b}{a}\right)^{\frac{1}{12}} = m^{\frac{1}{9}}.$$

Again, since

$$\left\{\left(\frac{a}{b}\right)^{\frac{1}{24}} - \left(\frac{b}{a}\right)^{\frac{1}{24}}\right\}^2 = \left(\frac{a}{b}\right)^{\frac{1}{12}} - 2 + \left(\frac{b}{a}\right)^{\frac{1}{12}},$$

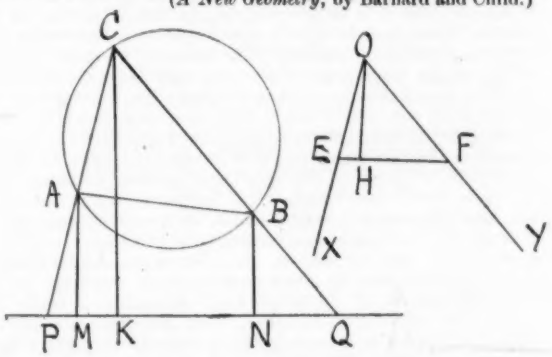
$$\therefore \left(\frac{a}{b}\right)^{\frac{1}{12}} + \left(\frac{b}{a}\right)^{\frac{1}{12}} = 2 + \left\{\left(\frac{a}{b}\right)^{\frac{1}{24}} - \left(\frac{b}{a}\right)^{\frac{1}{24}}\right\}^2.$$

$$\therefore m^{\frac{1}{9}} = 2 + \left\{\left(\frac{a}{b}\right)^{\frac{1}{24}} - \left(\frac{b}{a}\right)^{\frac{1}{24}}\right\}^2.$$

Now if $\left(\frac{a}{b}\right)$ is real, the square of $\left\{\left(\frac{a}{b}\right)^{\frac{1}{24}} - \left(\frac{b}{a}\right)^{\frac{1}{24}}\right\}$ cannot be a negative quantity. Hence $m^{\frac{1}{9}}$ cannot be less than 2, and therefore m cannot be less than 2^9.

X. Y. Z.—From two given points A, B draw two equal straight lines AP, BQ to a given straight line PQ, so that AP, BQ are at a given inclination to one another.

(*A New Geometry*, by Barnard and Child.)



Let A, B be the given points, PQ the given straight line, and XOY an angle equal to the given angle of inclination. Draw AM and BN perpendicular to the given straight line PQ. Join AB, and on AB describe a segment of a circle ACB containing an angle equal to the angle XOY.

On OX take OE equal to BN, and on OY take OF equal to AM. Join EF, and draw OH perpendicular to EF. At B draw BQ, making the angle NBQ equal to the angle HOF. Produce QB to meet the arc ACB in C. Join CA, and produce it to meet the given straight line in P.

Then PA shall be equal to QB.

Draw CK perpendicular to PQ.

Because the angle NBQ is equal to the angle HOF, and each of the angles BNQ, OHF is a right angle, therefore the angle NQB is equal to the angle HFO. And the angle EOF is equal to the angle PCQ. Hence the triangles PCQ, EOF are equiangular.

$$\therefore \frac{PC}{CQ} = \frac{EO}{OF} = \frac{BN}{AM}.$$

Again, because each of the lines AM, BN is parallel to CK,

$$\therefore \frac{PC}{CK} = \frac{PA}{AM}, \text{ and } \frac{CK}{CQ} = \frac{BN}{BQ}.$$

$$\text{Hence } \frac{PC}{CK}\cdot\frac{CK}{CQ} = \frac{PA}{AM}\cdot\frac{BN}{BQ},$$

$$\text{and } \therefore \frac{PC}{CQ} = \frac{PA}{BQ}\cdot\frac{BN}{AM}.$$

$$\text{But it has been shown that } \frac{PC}{CQ} = \frac{BN}{AM},$$

$$\therefore \frac{BN}{AM} = \frac{PA}{BQ}\cdot\frac{BN}{AM}.$$

$$\text{Hence } \frac{PA}{QB} = 1;$$

that is, PA = QB.

Therefore from A and B two equal straight lines AP, BQ have been drawn to meet the given straight line PQ, and inclined to one another at a given angle.

Seneca.—We have not been able to find a book that treats the subject more fully than is done in the work you name.

Our Prize Competitions.

RULES.

1. All translations and other competitive matter should be **posted not later than February 8, 1908,** and addressed:—PRIZE EDITOR, Office of *The Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the *coupon* which appears on the Back Wrapper page of the current number. One coupon must be sent for each entry.
3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

I.—FRENCH TRANSLATION COMPETITION.

A Prize of **Half a Guinea** is offered for the best rendering into English of the following extract:—

La coexistence, dans la société médiévale de deux mondes, le monde *latin* et le monde *vulgaire*, le monde *clérical* et le monde *laïque*, ne saurait être assez rappelée à l'attention de ceux qui veulent comprendre cette époque. C'est par là que la France du moyen âge diffère des sociétés de l'Inde ou de la Grèce auxquelles nous l'avons comparée. La masse de la nation puise son instruction ailleurs que dans les livres; elle a une poésie à elle, transmise oralement et renouvelée sans cesse avec les changements de la langue. A part de cette multitude, au-dessus d'elle intellectuellement, se maintient le cercle étroit des hommes qui savent le latin, qui connaissent l'antiquité latine, sacrée et profane, qui, seuls d'abord, écrivent l'histoire, cultivent la théologie, la philosophie et le peu de science qui s'est sauvé du naufrage. Cette juxtaposition de deux mondes était inconnue à la Grèce primitive, où l'écriture était étrangère à toute la nation, et à Rome, où l'écriture était familière à toute la nation, ou du moins à toute la classe supérieure; particulière à notre moyen âge, elle a été pour la littérature vulgaire de ce temps une cause de manifeste infériorité. Cette littérature ne fut pas cultivée, d'ordinaire, par les hommes qui se sentaient une valeur intellectuelle et des lumières supérieures. Puis, quand les clercs se décidèrent à y prendre part, ce fut pour y introduire des conventions, une science, des idées qui n'étaient pas, comme en Inde ou en Grèce, sorties spontanément de la nation, mais étaient empruntées telles quelles à une tradition éloignée, mécaniquement transmise et comprise très imparfaitement.

From "Esquisse Historique de la littérature française au Moyen Age," by GASTON PARIS.

RESULT OF THE DECEMBER COMPETITION.

The prize is awarded to "Twelfth Night." (Will "Twelfth Night" kindly forward name and address for publication?)

First Class.—Atlas, Shakspere, Jonenri, Æneas, Comet, Phantasie, Monaghan, St. Dié, Wrecun, Snowflake, Surprise, W. N. C., Noël, St. Mungo, Tyro primus, Sans souci, Kroy, Florentia, Una, L., T. V. D., Maclaurin, Arion, Bluebell, Jan, Nell of Tarc, Margaret, Dorma, Gorm, Violin, Rocket, Our mutual friend, I. G., Mifanwy, Winnowsty, Gladiator, Oiseau, C. J. F. Bennett.

Second Class.—Wi, G. P. C., Mizpah, Camfield, Welsh Girl, Thaw.

The name and address of "Keeldees," the winner of the last competition, are—Mr. Jack Fraser, 15 Thirlestane Road, Edinburgh.

REPORT.

The comparative easiness of the piece set accounts for the large number in the first class, but there was not a great number of translations of anything like distinguished merit. A curious example of mistranslation was afforded by three competitors, who translated *prétendue défaite* by "emaciated future wife," "lean intended," and "meagre future wife," respectively. These mistranslations illustrate the danger of rendering isolated phrases without reference to the context. The phrase by itself is quite capable of the translations given, which, however, cannot be reconciled with the whole sentence in which it appears, nor with the description of the widow as being *bien faite*. We have not been able to explain to ourselves what was passing through the mind of the competitor who rendered *déplurent tout d'abord à Germain* as "instantly proclaimed the German."

PRIZE TRANSLATION.

Widow Guérin had a good figure, and her complexion was well preserved, but her expression of face and her get-up annoyed Germain from the very outset. She looked bold and self-satisfied, and her caps, trimmed with three rows of lace, her silk apron, and her fichu were not in the least suitable, in his idea, to a serious-minded settled widow. Her fastidiousness in matters of dress and her free and easy manners made him look upon her as old and ugly, though in reality she was neither. He considered that her smart way of dressing and her lively manners would suit little Marie's age and sharp wits, but that this widow's mind was dull, and her jokes sometimes in doubtful taste, and that her fine clothes did not make a lady of her. The three suitors were seated at a table laden with wines and meat, which were always there for them on Sunday mornings; for old Leonard liked to show off his riches, and the widow was not sorry either to set out her beautiful china, and to keep open house like a lady of means. Germain, although naturally simple and confiding, was nevertheless fairly observant, and for the first time in his life he was on his guard when the toasts began. Old Leonard had made him sit down with his rivals, and seating himself opposite to him helped him to the best of everything, and paid him special attention. The present of game, notwithstanding the inroad which had already been made in it by Germain, was still large enough to make an effect. The widow seemed pleased by it, and the suitors glanced at it contemptuously. Germain was annoyed at being considered already in love, and the widow's affected manner as she lowered her eyes and smiled, as though sure of herself, made him feel inclined to protest against his supposed conquest; but he was afraid of seeming rude, so he smiled and resolved to be patient. "TWELFTH NIGHT."

II.—ENGLISH LITERATURE COMPETITION.

For this competition fifteen lists have been sent in, and all are both well selected and interesting, making it difficult to award the prize. The best, in our judgment, is that submitted by *Theo*, but those sent in by *Booklover* and *Lindum* run it closely, and we have decided to give a New Century volume to each of these two competitors also. Will *Theo*, *Booklover*, and *Lindum* each kindly send name and address? The prize-list runs as follows. The books are intended for a male teacher:—

1. Shakespeare's complete works.
2. Wordsworth's poems.
3. Tennyson's poems.
4. Carlyle's *French Revolution.*
5. Burnet's *History of Our Own Times.*
6. Lockhart's *Life of Scott.*
7. Boswell's *Life of Johnson.*
8. Southey's *Life of Nelson.*
9. Macaulay's *Essays.*
10. Lamb's *Essays of Elia.*
11. Addison's *Spectator.*
12. Ruskin's *Modern Painters.*
13. Marcus Aurelius' *Meditations.*
14. Plato's *Republic.*

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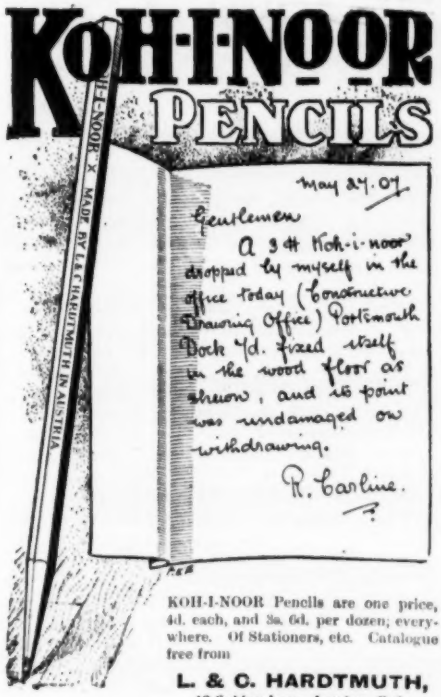
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17. Scott's *Ivanhoe.*
18. George Eliot's *Adam Bede.*
19. Carlyle's *Sartor Resartus.*
20. Ruskin's *Sesame and Lilies.*

Booklover's list is for a girl, and runs as follows:—

1. Ruskin's *Sesame and Lilies.*
2. Kingsley's *Two Years Ago.*
3. Browning's complete works.
4. Tennyson's complete works.
5. Shakespeare's complete works.
6. Lamb's complete works.
7. Macaulay's *Essays.*
8. Addison's *Essays.*
9. Arnold's *Essays in Criticism.*
10. R. L. Stevenson's *Across the Plains.*
11. Thackeray's *Vanity Fair.*
12. Blackmore's *Lorna Doone.*
13. Brontë's *Shirley.*
14. Dickens's *David Copperfield.*
15. Scott's *Woodstock.*
16. Mrs. Gaskell's *Cranford.*
17. Miss Mitford's *Our Village.*
18. Holmes's *Breakfast-Table Series.*
19. Carlyle's *Heroes and Hero Worship.*
20. George Eliot's *Mill on the Floss.*

The Editor is obliged to *Yshbel the Heightonian, Weltgeschichte, Odd ho, Ancient, Snowflake, Yorick, Nunnery Needlework, J. H. B., Augustus, M. C. V.,* and *Janus* for excellent lists, most of which fall a little below the standard owing to the inclusion of books which are scarcely classics, or which are somewhat of a professional character. A very good list, which begins with *The Life of Sir Walter Scott,* bears no pseudonym.

III.—HISTORY COMPETITION.

Only two papers have been sent in, so that we cannot, grammatically speaking, make an award for the "best" set of answers. We shall, however, be pleased to send the prize to *Snowflake* if that competitor will kindly forward name and address. The answers of *Weltgeschichte* fall very little short of those in the winning paper. *Scotia* answers only Question 6, but does that very well.

IV.—GENERAL KNOWLEDGE COMPETITION.

For this we have two entries only, and as *Snowflake,* the writer of the "better" paper, has already won a prize, no award will be made. We are obliged to *Shakspere* for contribution.

V.—QUOTATION COMPETITION.

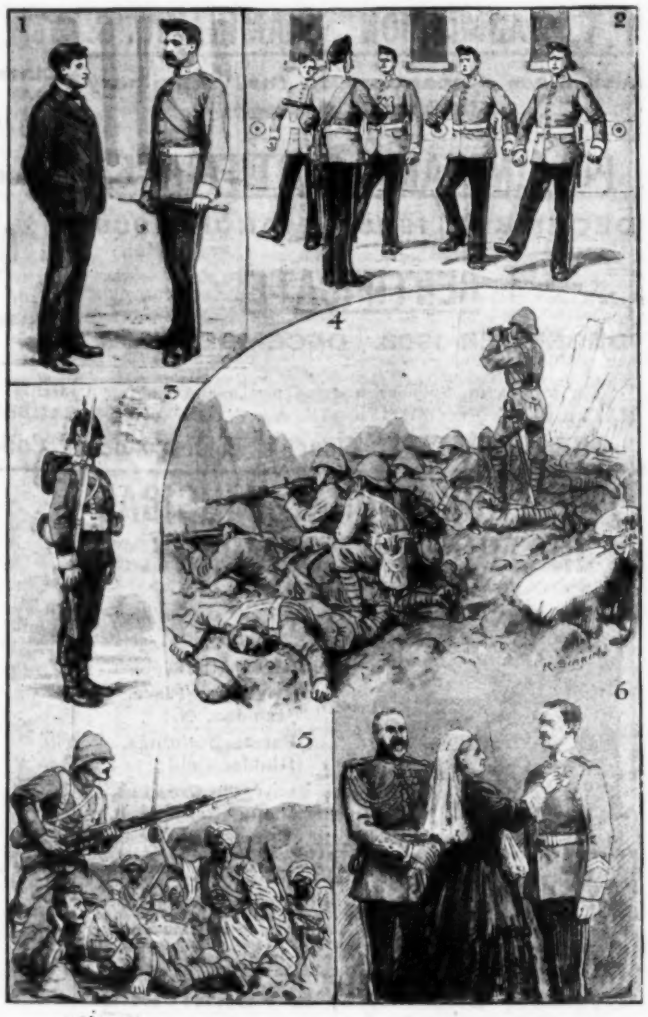
Only two entries here also. *Ge-em-lee* and *Carolus* each locate four of the quotations. This prize cannot therefore be awarded. In future competitions we hope to fix a minimum number of entries. The quotations were from the following sources:—1, Fitzgerald's translation of *Omar Khayyám;* 2, Rossetti's *Blessed Damozel;* 3, Stevenson's *Ex Triplex* in "Virginibus Puerisque;" 4, Meredith's *Love in a Valley;* 5, Hood's *Ode to Autumn;* 6, Ruskin's *Modern Painters;* 7, Matthew Arnold's *Sonnet to Shakespeare.*

VI.—A COMPETITION FOR PROPHETS.

The answers of *Snowflake,* the only entrant for this competition, are interesting. 1. In flying machines. 2. Practical science and technical training will, with very few exceptions, replace the study of the classics ["Angels and ministers of grace defend us!"—Prize Editor]. Practical object lessons, visits to markets, factories, mills, etc., will replace the schoolroom lesson, or rather be conjoined to it. The study of civics will be enforced in all schools, primary and secondary. 3. John Burns. 4. Will be performed by skilled, trained, educated women of the same standing in life as the mistresses. In time the men, very likely, of good social standing will follow the example set by the women.

VII.—A COMPETITION FOR PUPILS.

The Editor offers a *First Prize* of *Five Shillings* and a *Second Prize* of *Half a Crown* for the best story based upon the accompanying illustration. Competitors must not be older than twelve years; and in awarding the prizes the Editor will take into consideration the exact age of the writer, and the careful manner in which all the details of the picture have been used in the narrative.



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N.B.—The following competitors were too late for this month's issue:—*Shamrock* (French Translation), *Shakspere* and *W. M. E.* (English Literature).

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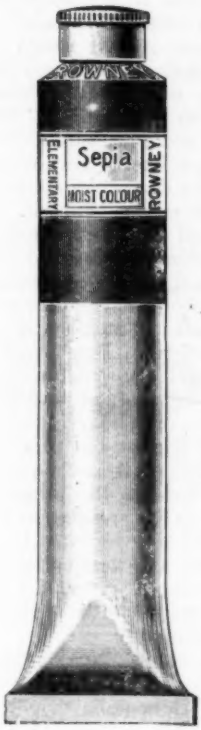

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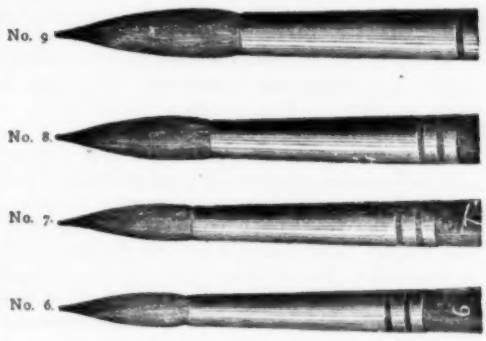

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THE EDITOR'S BOOKSHELF

A NOTEWORTHY VOLUME.*

TOO many writers on education follow the historical method. It is encouraging, therefore, to come across a book like this that deals with the subject as a living present. It is true that Mr. Keatinge has to give a good deal of old matter at the beginning of his treatise, for he knows that his readers are not so familiar as they should be with the French and German contributions to his subject. After all, only a quarter of the volume is given up to the statement of the current views. Had it been written by a German we would not have got at the author's own contribution till three-quarters of the space had been given to a demonstration that he knew what had been said before his time.

In Chapters IV. and V. Mr. Keatinge gives us an admirable presentation of the educational bearings of suggestion, and particularly of the practical applications to the work of teaching. He believes that the word "suggestion" is much too loosely used, even by scientific writers; but it hardly seems worth while to find fault with other people's definitions, unless those people are inconsistent in their use of terms. The writers criticised are entitled to their limitation of the term, just as Mr. Keatinge in his turn is entitled to understand it in the somewhat negative sense that he finds most useful for his purpose.

The leading principle in the book is the importance of "contrariant ideas." The French classifiers of characters take full account of the contrariant form, but Mr. Keatinge is inclined to regard us all as contrariants more or less. In teaching, we must be particularly careful to let sleeping dogs lie. The positive rousing of suitable ideas is not enough: we must be always on our guard against rousing other ideas that, while perhaps in themselves valuable enough, are out of place in the connection with which we are interested, and are therefore dangerous.

Apart from the introductory part, the whole book might be almost better named "The Incidence of Consciousness." The essential distinction between direct and indirect suggestion is involved here, and in the two chapters referred to (IV. and V.) the teacher will find some exceptionally good material for thought.

Mr. Keatinge adopts a somewhat hostile attitude towards the Herbartian position, but the Herbartians will readily forgive him, since his method of treatment is essentially Herbartian. The interplay of ideas that he so skilfully works up is exactly what one would expect from a man with a genuine mastery of the Herbartian insight. The limitations of the views of Herbart himself in connection with character-forming are well brought out in Chapter VII., and the contributions of the French writers to a satisfactory solution are judiciously presented and utilised.

One likes the frankness behind such a statement as, "The problem of the relation between knowledge and conduct is one for which it is not likely that a final solution will ever be found." This prepares us for a somewhat disappointing conclusion to the whole matter, and at first sight we seem to have very little granted to the teacher in the way of character-forming power. We are disposed to think that Mr. Keatinge agrees with Mr. Bernard Shaw in regarding any attempt at modifying character as a sort of moral abortion. But in the chapter on "Education as Creative" we find an ingenious argument that grants to the educator all the power he needs for his purpose. The law of the conservation of energy is no doubt valid in the physical sphere, and even in the intellectual, so far as that is concerned with what may be called drill. So soon, however, as we enter the region of "meaning" we leave the law of the conservation of mental energy behind us. The teacher may communicate knowledge to another all day without being the poorer in knowledge. Virtue is no doubt going out of him all the time, but it leaves him none the poorer. So hopeful is our author in his theory that he accepts the challenge that has been so often hurled at the educator. If you can really educate, it is often asked why are there so few Shakespeares and Newtons? Mr. Keatinge replies, "Given a sufficient number of suggestive teachers, and a consequent differentiation of one personality from another among their pupils, the play of circumstances will see to it that the freaks whom we call men of genius are produced in increasing numbers."

In his practical applications our author seems to adopt the Dooley attitude. He appears to regard the hardness or distastefulness of a subject as in itself something desirable. He lays it to the credit of "the older type of teacher" that "he made his pupils work hard at subjects that they did not like." But surely it is the teacher's business to make distasteful subjects cease to be distasteful. Mr. Keatinge himself, in some passages that are beyond all praise, shows how the Classics (even such commonplaces as Cæsar's) can be so taught that "there is no difficulty in interesting the class, in giving them abundance of hard and problematic work of every kind, and of making moral suggestions upon this basis of effort." But here we have the hard and the distasteful opposed to each other. The work is hard but not distasteful, and this is all that the reasonable advocates of interest demand. They do not want to get rid of drudgery, but to make drudgery cease to be drudgery, because it has acquired meaning and purpose. Nobody defends the principle of the soft option. With regard to the training of the will through ideas, no treatment can be considered satisfactory that does not include an examination of Jules Payot's *L'éducation de la Volonté*. It would have been worth Mr. Keatinge's while to add another chapter so as to include his criticisms on this work.

Teachers are very commonly of the opinion that anything is fair in school work so long as it leads to the improvement of the pupil. It is well, therefore,

* *Suggestion in Education.* By M. W. Keatinge, M.A., Reader in Education in the University of Oxford. (Adam and Charles Black.)

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that the fundamental question of the sanction of suggestion should be raised in a work of this kind. Nothing could be better than the treatment we have here of this difficult question. The reverence for individuality is widespread in these days, and Mr. Keatinge is not behind others in his claims. But he is able to make a capital case for the use of suggestion without compromising the independence of either teacher or pupil. Incidentally he introduces certain considerations that cannot fail to be of interest and practical utility at a time when the problem of religious instruction is occupying so much public attention.

Our main fault to the book is really a compliment: we want more of it. Several questions have not been sufficiently worked out—for example, the relation between the subconscious and the unconscious: a much more than academic question—but the book as it stands is very welcome. It is full of interest, it teaches us much, it suggests more. No teacher, however experienced and able, will regret the time spent over this profitable volume.

PREPARATION FOR LITERATURE.*

THE wide discrepancies between the educational theories of the psychologist and the practical teaching that obtains in our schools has long been a matter of comment; but if there is any point on which both theorists and practical teachers agree, it is the paramount importance of awakening and sustaining the interest of the scholars in the matter in hand, and there is possibly no subject to which this applies more forcibly than to reading. It is therefore most remarkable that the powers that be have for many years regarded the reading book as a vehicle for imparting information, and have looked askance at any book that aimed at being interesting rather than instructive. Happily this state of things has passed away, and the Code no longer prescribes the number or nature of the readers, but merely stipulates that they shall include pieces of literary merit.

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Petit Histoire du Peuple Français. Par Paul Lacombe. Illustré de 80 *gravures. (Bibliothèque des Écoles et des Familles.)*

This handsome addition to the well-known series in which it is included stands high as to its literary and educational merits. As a history, it deals less with matters political and military than with the progress of civilisation among the people. The social condition, as expressed in land-tenure, serfdom, town life, and other forms and institutions, occupies a very large space. To one who already has some acquaintance with the chronological skeleton of French history this work can be cordially recommended as scientific and illuminating. It is well illustrated and handsomely produced.

L'Enfant Millionaire (Katharina Green), Roman traduit de l'Anglais. Par J.-H. Rosny. Illustrations d'après M. Mahut. (Petite Bibliothèque de la Famille.)

This is one of a dainty series of volumes, all of which are not only "safe" but really good reading. The American story here reproduced is one of engrossing interest, and there is no lack of mystery and of movement. The name of the translator is sufficient guarantee for the quality of the French. The book seems admirably suited for presentation or prize purposes in senior classes.

La Famille Grinchu. Par Mdlle. G. du Planty. Illustré de 54 *vignettes par E. Zier.*

For younger children this is a capital book. The "Grinchu" family—well named thus, seeing that they were perpetually grumbling and quarrelling—pass through numerous adventures in its pages. The holiday visit to the country cousins and to the seaside gives ample scope for their speciality in the way of making themselves disagreeable. Yet the writer has a clear ethical purpose in view throughout, and without straining too much the limits of possibility she succeeds in bringing home the family completely cured of their unamiable characteristics. The tone is thus eminently wholesome for young readers.

Petits Tableaux d'Histoire de France par l'Image. Par Gauthier et Deschamps.

This is essentially a picture book, though the pictures are accompanied with short explanatory paragraphs. The pictures form a chronological procession of persons and events in French history from the time of Julius Cæsar to the present day. Something is doubtless lost through the small scale of many of the drawings, but on the other hand it enables the complete story to be compressed into some thirty-two pages.

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N.B.—The Editor's Bookshelf is overcrowded with new publications for school use sent in during the last few weeks. Next month as many as possible will be dealt with in our review columns.

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